FINDING OF NO SIGNIFCANT IMPACT

ENVIRONMENTAL ASSESSMENT (EA)

LONG-TERM INTEGRATED MANAGEMENT OF MISSION-GENERATED SOLID WASTE

EDWARDS AIR FORCE BASE, CALIFORNIA

AGENCY: Department of the Air Force, Air Force Materiel Command (AFMC), Air Force Test Center, 412th Test Wing, 412th Civil Engineer Group, Environmental Management Division, Edwards AFB, California

BACKGROUND: This EA evaluates the potential environmental impacts associated with the long-term integrated management of mission-generated solid waste at Edwards AFB, California. Currently, all non-housing nonhazardous solid waste from daily operations at Edwards AFB are disposed of at the Main Base Active Landfill (MBAL). Several alternatives addressing long-term management of solid waste are evaluated, including closure of the MBAL, reducing operating days at the MBAL, and increasing the permitted capacity of the MBAL.

The landfill is operated by the 412th Civil Engineer Group, 412th Civil Engineer Squadron and is located on land owned by the U.S. Air Force. The landfill is classified as a Category 1, Class III Municipal Solid Waste (MSW) Disposal Site and, as such, only nonhazardous solid wastes are permitted for disposal. Solid waste management is a highly-regulated, costly, and necessary activity for Edwards AFB. Owning a landfill brings additional regulatory requirements and operational costs that may burden the Air Force with additional financial responsibility. However, with the high cost of closure (including permitting, physical closure, and long-term maintenance and monitoring), capital investment in the existing landfill, uncertain future of available landfill space and transportation costs, and security that comes with being self-sufficient, it may be beneficial to continue to operate the landfill despite high operational costs.

The purpose of the project is to establish a reasonable long-term plan for proper disposition of Base-generated solid waste in support of the Edwards AFB mission. The need is to properly process and dispose of mission-generated solid waste. The proposed action and alternatives will address the constantly changing mission, diminished solid waste stream, increased operational costs and increased regulatory requirements.

ALTERNATIVE 1 (PROPOSED ACTION) – CLOSURE OF THE MAIN BASE LANDFILL AND OFF-SITE TRANSPORTATION AND DISPOSAL: With this alternative, the MBAL would be closed in accordance with State of California closure and post-closure maintenance requirements as promulgated by the California Department of Resources, Recycling, and Recovery (CalRecycle) and the State Water Resources Control Board (SWRCB). Closure of the MBAL could be accomplished by using either a prescriptive cover or an alternative cover design, both of which would comply with State requirements. The prescriptive cover would consist of a two-foot thick foundation layer, a one-foot (minimum) low-hydraulic conductivity layer, and an erosion-resistant layer capable of sustaining native vegetation planted during closure. The alternative cover would consist of either a geosynthetic or

evapotranspiration cover, both of which would require much less soil material to be transported from off-base and, therefore, would be much less expensive to install than a prescriptive cover.

Until such time that a study can be conducted to determine the viability of cover material on base (usually done while developing the closure plan, which is three years prior to closure), it is assumed that an alternative cover design would be the preferred cover for the closed landfill.

After closure, the landfill would require regular inspection, maintenance, and monitoring activities. These activities would continue for 30 years or more after landfill closure (Title 27 CCR, Section 21180) or as long as wastes pose a threat to water quality (Title 27 CCR, Section 20390), whichever lasts longer.

Following closure, all waste from Edwards AFB would be transported to off-base landfills for disposal. Concurrent with landfill closure, the staff at the Base would continue to work to maximize reuse and recycling which would allow for reduced waste collection and transportation costs, and minimized tipping fees at off-base landfills. New recycling and waste reduction practices and technology, would be monitored and evaluated for applicability and conformity with Edwards AFB policies and mission.

ALTERNATIVE 2 – CLOSURE OF THE MAIN BASE LANDFILL AND USE OF AN ON-BASE TRANSFER STATION: With the Alternative, closure of the MBAL would be as described for Alternative 1, but instead of hauling all waste directly to off-base landfills, the waste would be brought to the MBAL site for sorting and consolidation before transfer and final disposal off base. Transfer stations provide the capability of consolidating materials from smaller waste collection trucks into vehicles with higher capacities, thus conserving energy and minimizing vehicle trips to a disposal or recycling facility. Once the materials are consolidated, they can be delivered to a materials recovery facility (MRF), recycler, or to a distant landfill. Maintaining a transfer station along with the recycling center would facilitate some sorting and recovery of recyclables from the waste stream.

Transfer trucks hauling waste from a transfer station to a landfill have an average capacity of 20 tons. It would require about a day and a half to consolidate enough waste from Edwards AFB to fill a single transfer truck unless waste from other parts of the Base not currently buried at the landfill were also consolidated at the transfer station. The distance from Edwards AFB to the nearest landfill, Boron Sanitary Landfill, is approximately 22 miles. Adjacent active landfills, including Boron and Mojave-Rosamond Sanitary Landfills, have over 100 years of disposal capacity and could easily accommodate the quantity of waste generated by Edwards AFB.

ALTERNATIVE 3 – FEWER OPERATING DAYS: Another alternative to address the decreasing waste generation rate at Edwards AFB would be to reduce operating costs by reducing operating days to three times per week. The operational assumption is that it would be difficult to hire a contractor to operate a remote facility like the MBAL on a part-time basis. Therefore, to operate the landfill less than five days per week would require the operation to be performed by in-house personnel.

ALTERNATIVE 4 – VERTICAL EXPANSION OF THE MAIN BASE ACTIVE LANDFILL: The MBAL currently has an estimated life expectancy of 62.1 years and closure date of May 2076; therefore, an expansion is not critical at this time. However, if the capacity of the landfill could be expanded with minimal cost, the additional airspace may have significant

value in the future. Lateral expansion has been determined to be cost prohibitive, but vertical expansion could be accomplished fairly easily and would extend the life expectancy of the landfill. Vertical expansion could also be used to accommodate additional waste at the MBAL, whether it be construction and demolition (C&D) waste that is currently being sent off base or waste from a new source such as a new group or squadron coming to the Base or from Air Force-related uses off base that may be looking for a landfill for their waste.

The 10-foot vertical expansion would provide approximately 885,000 cy of additional airspace and 70 years of additional site life, based on the historically low FY 2014 disposal rate of about 10 tons per day. For comparison, if the landfill were to accept the permitted maximum of 350 tons per day, the landfill life would only be extended by 2.8 years with the vertical expansion. Adding 70 years of site life to a landfill with a 60-year lifespan is not necessary in the short term. However, this alternative may be more viable if there were substantial changes in operations at the Base requiring additional landfill capacity.

ALTERNATIVE 5 – NO-ACTION ALTERNATIVE: Under the No Action Alternative, the MBAL would remain under contractor operation until the closure date was reached. The operation costs would remain similar to current conditions and the waste acceptance rate would continue to fluctuate with changing mission requirements and increased diversion efforts. At some point in the future, the landfill would be closed, in a process similar to the one described for Alternative 1.

SUMMARY OF ENVIRONMENTAL EFFECTS FOR THE ALTERNATIVES:

Air Quality and Greenhouse Gases. Construction and operational emissions for all alternatives would be well below significance thresholds and would not be significant. Incorporation of minimization measures (MM) AQ-1 and MM AQ-2 to minimize fugitive dust emissions and to ensure compliance with state off-road regulations would further reduce air quality and greenhouse gas emissions.

Cultural Resources. The waste footprint as well as the supporting landfill activities area would not expand beyond current boundaries with any of the alternatives. The project site is enclosed by a fence and the entire area is disturbed by existing landfill activities. After closure, the landfill would require regular inspection, maintenance, and monitoring activities. Because, the landfill area has already been extensively disturbed by ongoing landfill activities, and no new areas would be disturbed, it is unlikely that there would be any impacts to cultural resources with this alternative. There is a small potential for inadvertent discoveries during final grading of the site. However, with incorporation of MM CUL-1, no impacts to cultural resources are anticipated.

Geology and Soils. No significant impacts related to geology or seismicity would occur with any of the alternatives and no mitigation measures are required. There is the potential for wind or water erosion of soil to occur at the landfill. With incorporation of MM GEO-1, these impacts would be kept to a level that is not significant.

Hazardous Materials and Hazardous Waste. For the closure alternatives, the MBAL would be closed in accordance with current State of California requirements. Following closure, all waste from Edwards AFB would be transported to off-base landfills for disposal and the closed landfill would be subject to regular inspection, maintenance and monitoring activities.

Implementation of any of the alternatives would not mobilize existing contaminants associated with MBAL Site 4 in groundwater, or expose workers to contaminated soils or groundwater at levels in excess of those permitted by federal and state law. Hazardous materials necessary for project implementation that require temporary storage at the construction area would comply with relevant Edwards AFB requirements. Implementation of MM HAZ-1 would further reduce potential hazards to workers from hazardous materials or hazardous waste during landfill closure activities to a level that is not significant.

Infrastructure. There would be a long-term, minor decrease in the need for infrastructure utilities, and there would be a long-term increase in vehicular traffic off the Base due to transport of materials from the MBAL to an off-Base landfill. No significant impacts to infrastructure would occur and, therefore, no mitigation or MMs would be required.

Natural Resources. No native vegetation or wildlife communities would be directly removed, nor sensitive species directly affected because the landfill area has already been disturbed by existing landfill activities and is surrounded by a fence, and all closure activities at the MBAL would take place within the already fenced area. Construction and monitoring activities associated with the landfill closure could have direct and temporary impacts to nesting birds, including possibly burrowing owls and other sensitive bird species, considered a significant impact if they were in violation of the federal Migratory Bird Treaty Act (MBTA). Implementation of MM NR-1 would avoid these impacts.

Indirect temporary impacts associated with closure activities or ongoing monitoring and maintenance activities may include locally increased noise and dust. Because the MBAL currently supports activities that create noise and ambient dust conditions exist in the Mojave Desert, the temporary increase of these factors in localized areas for the closure activities is expected to be minimal. This impact is expected to be less than significant and requires no avoidance and minimization measures.

With the incorporation of MM NR-1 into the project, no significant natural resources impacts are likely to occur.

Noise. Noise associated would primarily result from vehicles used during the transport of soil for constructing the landfill cover and from hauling waste from the Base that would need to be collected and then transported off Base. Post-closure noise would be related to activities required for the maintenance of the prescriptive final cover and erosion control, landfill gas monitoring and well maintenance, groundwater monitoring and well maintenance, drainage improvements, access and security, and site administration. All impacts would be negligible and not significant.

Socioeconomics. Closure of the landfill would not create significant impacts to socioeconomics in the on- or off-base region, although it would generate a very small number of temporary jobs, which would be a beneficial impact on economic conditions in the area. A very slight increase in local revenues would be expected to occur as a result of money spent for construction materials and daily services. This increase would not measurably affect housing or schools in the area. All impacts would be negligible and not significant.

Hydrology and Water Quality. Closure of the MBAL has the potential for impacting local water quality due to wind and water erosion. Sporadic heavy rainfall events that occur in the vicinity of Edwards AFB can result in brief episodes of surface runoff in shallow erosion gullies

and depressions in the ground surface. Run-on to the landfill area, regionally from the northeast to the southwest, may reach the landfill/balefill. This run-on would be diverted around the in-place waste with daily cover material. To prevent post-closure run-on of storm water from impacting the landfill area during and following a major rainfall event, a drainage interception system along the northeastern side of the balefill and the existing landfill has been proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road (U.S. Air Force 2014b). The system, designed to handle a 100-year, 24-hour storm, would collect off-site run-on from the upland drainage by use of interception channels that would divert the flow around the site. Current landfill operations are subject to the requirements of an existing Storm Water Pollution Prevention Plan (SWPPP). This SWPPP would either be updated for closure activities, including development of the drainage improvements, or a new one may be required at the discretion of the Regional Water Quality Control Board (RWQCB.) Impacts to riverine systems in proximity to the landfill would be avoided where feasible. This includes keeping equipment staging areas in upland areas outside stream channels. Best Management Practices (BMPs) to reduce impacts from erosion to water quality would be identified in the closure Waste Discharge Requirements (WDR) permit. Some generic BMPs may include: silt fences, fiber rolls, sediment/infiltration basins, and hydroseeding/vegetation establishment. Implementation of MM HYD-1 MM HYD-2 would reduce potential water quality impacts from the project due to erosion to a level that is not significant.

SUMMARY OF MINIMIZATION MEASURES: The following minimization measures would be incorporated into the project, thereby ensuring that all impacts would remain at a level that is not significant.

MM AQ-1: The following dust control measures are required to be implemented during land preparation, excavation and/or demolition:

- All soil excavated or graded should be sufficiently watered to prevent excessive dust. Watering should occur as needed with complete coverage of disturbed soil areas. Watering should be a minimum of twice daily on unpaved/untreated roads and on disturbed soil areas with active operations.
- All clearing, grading, earth moving and excavation activities should cease during periods of winds greater than 20 miles per hour (mph) (averaged over one hour), if disturbed material is easily windblown, or when dust plumes of 20% or greater opacity impact public roads, occupied structures, or neighboring property.
- All fine material transported off site should be either sufficiently watered or securely covered to prevent excessive dust.
- All haul trucks should be required to exit the site via an access point where a gravel pad or grizzly has been installed.
- Stockpiles of soil or other fine loose material shall be stabilized by watering or other appropriate method to prevent wind-blown fugitive dust.
- Once initial leveling has ceased, all inactive soil areas within the construction site should either be seeded and watered until plant growth is evident, treated with a dust palliative, or watered twice daily until soil has sufficiently crusted to prevent fugitive dust emission.
- On-site vehicle speed should be limited to 15 mph.

- All areas with vehicle traffic should be paved, treated with dust palliatives or watered a minimum of twice daily.
- Streets adjacent to the project site should be kept clean and accumulated silt removed.

MM AQ-2: The following measures should be implemented to control construction vehicle tailpipe emissions:

- Properly maintain and tune all internal combustion engine powered equipment;
- Require employees and subcontractors to comply with the California Air Resources Board idling restrictions for compression ignition engines; and
- Use California ultra-low sulfur diesel fuel.

MM CUL-1: Although the areas to the west, south, and east surrounding the MBAL have been previously surveyed for archaeological resources, those surveys are now over 10 years old and areas that may be affected by closure of the landfill will require re-survey. The area to the north of the MBAL has never been surveyed for archaeological sites. Therefore, up to approximately 300 acres of archaeological survey will need to be conducted on the west, north, and east sides of the MBAL. If avoidance of any newly recorded archaeological sites is not feasible then those sites will be subject to evaluation to determine their eligibility to the National Register and subsequent treatment in accordance with Section 106 of the National Historic Preservation Act. In the unlikely event that subsurface archaeological resources are discovered, work will cease immediately in the area and the Base Historic Preservation Officer (BHPO) will be contacted. A records search for any landscapes or traditional cultural properties will also be conducted by contacting the Native American Heritage Commission as well as the four federally-recognized tribes affiliated with Edwards AFB.

MM GEO-1: Controls such as the use of water to reduce dust and stormwater control devices such as the installation of a drainage interception along the northeastern side of the balefill and the existing landfill is proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road. The system, designed to handle a 100-year, 24-hour storm, would collect off-site run-on from the upland drainage by use of interception channels that will divert the flow around the site.

MM HAZ-1: Prior to construction activities associated with the landfill closure, a health and safety plan in compliance with 29 CFR 1910.120 will be prepared and approved by Edwards AFB. The site-specific health and safety plan will address all site-specific safety and environmental hazards that have the potential to be encountered during construction of the alternative, including physical hazards, biological hazards, and general safety hazards. Any training required by construction personnel will be identified.

MM NR-1: Pre-construction surveys will be conducted during nesting season to ensure compliance with the federal MBTA and avoid nesting impacts to burrowing owls and other bird species. These surveys will be conducted no more than 5 days in advance of initial disturbance. If the project impacts are to occur during the breeding season and owls or nesting birds are found occupying habitat within the disturbance area, disturbance of nests will not occur until the end of the breeding season. If the project impacts are to occur outside of the breeding season and owls or other nesting birds are found occupying habitat within the disturbance area, passive relocation

(via one-way doors and collapse of burrows) will occur. If no active nests are found within the disturbance area during the pre-construction surveys, the proposed disturbance activities may proceed.

MM HYD-1: The selected alternative may require a SWPPP in support of a National Pollutant Discharge Elimination System (NPDES) permit in connection with closure activities. Implementation of a SWPPP would ensure downstream water quality as sediment erosion would be controlled and sediment movement from the proposed alternative during construction would be reduced.

MM HYD-2: The selected alternative will require issuance of closure WDRs by the RWQCB pursuant to CCR, Title 27 to identify potential impacts to regulated waters as well as associated impact minimization measures. Where feasible, impacts to regulated waters would be avoided and BMPs for reducing erosion impacts to water quality would be identified and implemented.

SUMMARY OF PUBLIC REVIEW AND INTERAGENCY COORDINATION: Copies of the Draft EA were mailed to 1 agency, 7 libraries, and the California State Clearinghouse. A public notice was published in the Antelope Valley Press on 22 July 2016. This began the 30-day public comment period. The public comment period ended on 28 October 2016 and comments were received from one agency.

FINDING OF NO SIGNIFICANT IMPACT:

Based upon my review of the attached EA, I conclude that none of the Alternatives would have a significant, direct, indirect or cumulative impact on the environment. A Finding of No Significant Impact (FONSI) for the Proposed Action and Alternatives is made based on the absence of potentially significant impacts to the natural and manmade environment of Edwards AFB. Accordingly, the requirements of the National Environmental Policy Act, regulations promulgated by the President's Council on Environmental Quality, and 32 CFR part 989 are fulfilled and an Environmental Impact Statement is not required. Background information that support the research and development of this FONSI and EA is on file at Edwards AFB and can be obtained by contacting the following:

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James E. Judkins

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Base Civil Engineer

28 Nov 16
Date

412th Test Wing
Civil Engineer Group
Environmental Management Division
Edwards Air Force Base, California

FINAL ENVIRONMENTAL ASSESSMENT

LONG-TERM INTEGRATED MANAGEMENT OF MISSION-GENERATED SOLID WASTE

EDWARDS AIR FORCE BASE, CALIFORNIA

November 2016

Project File: Environmental Assessment for Long-Term Integrated
Management of Mission-Generated Solid Waste at
Edwards Air Force Base, California
AF Form 813 #15-0378

COVER SHEET

ENVIRONMENTAL ASSESSMENT FOR LONG-TERM INTEGRATED MANAGEMENT OF MISSION-GENERATED SOLID WASTE AT EDWARDS AIR FORCE BASE, CALIFORNIA

Lead Agency: U.S. Air Force

Cooperating Agency: None

Proposed Action: Long-term Integrated Management of Mission-Generated Solid Waste

Point of Contact: Inquiries on this document should be directed to the 412th Test Wing Public Affairs, Attn: Gary Hatch, 305 East Popson Avenue, Building 1405, Edwards Air Force Base, California 93524, (661) 277-8707, e-mail 412tw.pae@us.af.mil

Report Designation: Draft Environmental Assessment (EA)

Abstract: This EA evaluates the potential environmental impacts associated with the long-term integrated management of mission-generated solid waste at Edwards AFB, California. Currently, all non-housing nonhazardous solid waste from daily operations at Edwards AFB are disposed of at the Main Base Active Landfill (MBAL). Several alternatives addressing long-term management of solid waste are evaluated, including closure of the MBAL, reducing operating days at the MBAL, and increasing the permitted capacity of the MBAL.

The landfill is operated by the 412 TW and is located on land owned by the U.S. Air Force. The landfill is classified as a Category 1, Class III Municipal Solid Waste (MSW) Disposal Site and, as such, only nonhazardous solid wastes are permitted for disposal. Solid waste management is a highly-regulated, costly, and necessary activity for Edwards AFB. Owning a landfill brings additional regulatory requirements and operational costs that may burden the Air Force with additional financial responsibility. However, with the high cost of closure (including permitting, physical closure, and long-term maintenance and monitoring), capital investment in the existing landfill, uncertain future of available landfill space and transportation costs, and security that comes with being self-sufficient, it may be beneficial to continue to operate the landfill despite high operational costs.

The purpose of the project is to establish a reasonable long-term plan for proper disposition of Base-generated solid waste in support of the Edwards AFB mission. The need is to properly process and dispose of mission-generated solid waste. The proposed action and alternatives will address the constantly changing mission, diminished solid waste stream, increased operational costs and increased regulatory requirements.

This EA was prepared in accordance with all applicable federal, state, and local laws and regulations including the National Environmental Policy Act (NEPA) of 1969; the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA; and US Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process (EIAP)*. The 412th Test Wing (TW), Civil Engineer Group (CEG) is representing the Department of Defense (DoD) as the lead agency.

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1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

This Environmental Assessment (EA) evaluates the potential environmental impacts associated with the long-term integrated management of mission-generated solid waste at Edwards Air Force Base (AFB), California. Currently, all non-housing nonhazardous solid waste from daily operations at Edwards AFB are disposed of at the Main Base Active Landfill (MBAL). Several alternatives addressing long-term management of solid waste are evaluated, including closure of the MBAL, reducing operating days at the MBAL, and increasing the permitted capacity of the MBAL.

This EA was prepared in accordance with all applicable federal, state, and local laws and regulations including the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code [USC] 4321 *et seq*.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500–1508); and US Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process (EIAP)*, as codified in 32 CFR Part 989. The 412th Civil Engineer Group (CEG) is representing the Department of Defense (DoD) as the lead agency.

1.2 LOCATION OF PROPOSED ACTION

The Proposed Action would occur on Edwards AFB (the Base) which is located in the Antelope Valley region of the western Mojave Desert in Southern California, about 60 miles northeast of Los Angeles, California. The Base occupies an area of 307,517 acres or 470 square miles and consists of largely undeveloped or semi-improved land that is used predominantly for aircraft test ranges and maintained and unmaintained landing sites (i.e., dry lake beds). The Base is bounded by state highways 14 to the west and 58 to the north; and US Route 395 to the east; with county road Avenue E near the southern boundary of the Base. The developed portion of the Base includes approximately six percent of the total base area; it is concentrated on the west side of Rogers Dry Lake and includes North Base, South Base, Main Base, and Family Housing areas.

Most of the Base, including the MBAL, lies within Kern County, with smaller portions in Los Angeles and San Bernardino counties (Figure 1-1). Currently, the MBAL occupies portions of Sections 17, 20, and 21, Township 10 North, Range 10 West of the San Bernardino Baseline and Meridian. The landfill latitude and longitude are 34°57'N and 117°57'W, respectively. The site is located along Landfill Road about 1.3 miles north of the Edwards AFB family housing area. The landfill entrance and exit are located on Landfill Road. The total permitted landfill boundary is 137 acres, which includes a 60.5-acre disposal area, a Recycling Operations Center (ROC), a 4-acre composting facility/grinder operation, a baler building, weigh scales, and the landfill office (Figure 1-2).

Land adjacent to the MBAL (except the Main Base Inactive Landfill) is undeveloped natural desert. The nearest structure is an electrical substation approximately 1,000 feet from the landfill. The only livestock site in the area is a horse stable located within 1 mile southwest of the landfill. Military family housing (MFH) is located approximately 1.3 miles south of the landfill boundary. Several schools within that neighborhood are located approximately 1.7 miles south the landfill.

Elevations on the Base range from approximately 692 to 1,038 meters (2,270 to 3,404 feet) above mean sea level (AMSL) with the lowest elevations found in the two major dry lakebeds, Rogers and Rosamond Dry Lakes. Higher elevation areas are found along ridges in the Rosamond and Bissell Hills in the northwest area of the Base, along Leuhman Ridge in the northeast, and Haystack Butte in the southeast. The landfill site gently slopes to the southwest. Elevations range from 2,370 to 2,420 feet AMSL. Shallow, ephemeral drainage channels approach the area from the northeast, either crossing a part of the site or ending against an earth embankment to the northeast. The channels join a larger channel that parallels Landfill Road.

Edwards AFB lies in an extreme climate zone. The western Mojave Desert is characterized by both very high and very low temperatures, high winds, and rainfall typically less than 6 inches per year. The local climate is characterized by two well-defined seasons, summer (hot and dry) and winter (mild and occasionally moist), with two short transitional periods in the spring and fall. Due to the relatively high altitude (2,300 feet above sea level) and dry atmosphere, there is a wide daily range in temperature during most seasons. Most precipitation occurs between November and March.

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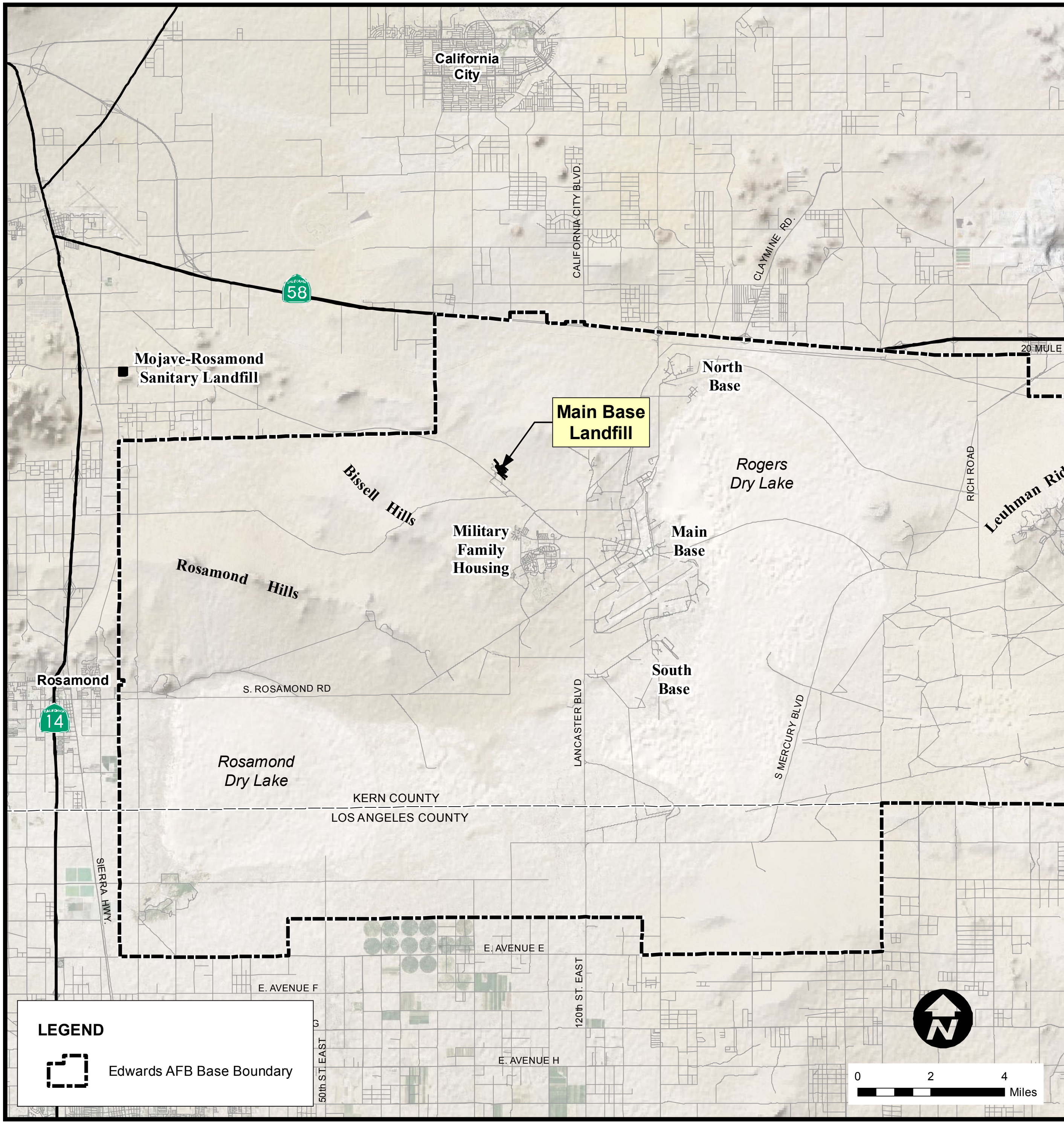
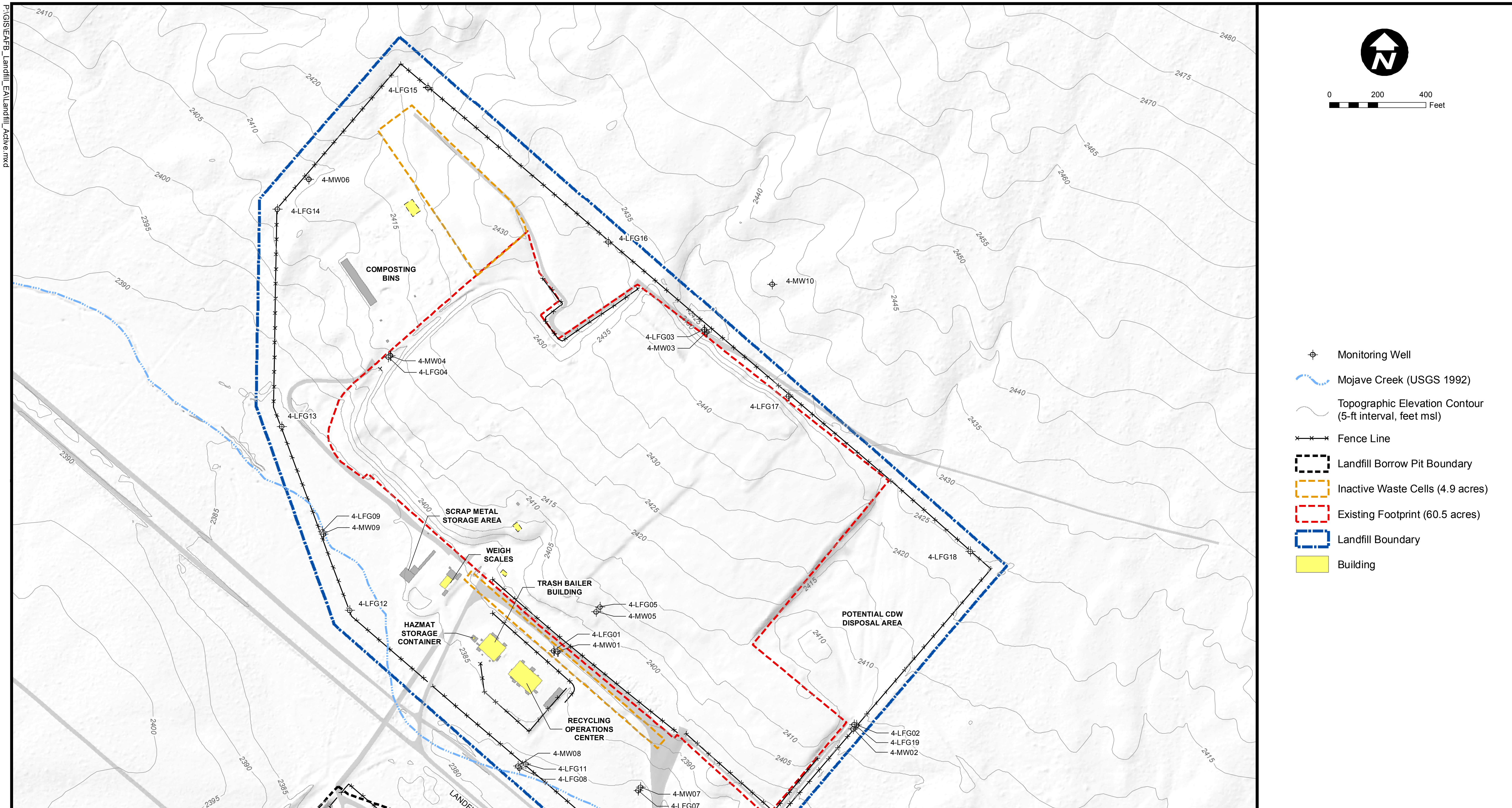


EDWARDS AIR FORCE BASE

Figure 1-1

Edwards AFB and Vicinity Map



EDWARDS AIR FORCE BASE

Figure 1-2

Main Base Active Landfill Site Map

1.3 BACKGROUND

The landfill is operated by the 412th Test Wing (412 TW) and is located on land owned by the U.S. Air Force. The landfill encompasses 137 acres, which include a 60.5-acre active disposal area, two inactive waste cells (4.9 acres), and a 4-acre composting area. The landfill is classified as a Category 1, Class III Municipal Solid Waste (MSW) Disposal Site as defined in 27 California Code of Regulation (CCR), Section 20260, and is operated under Solid Waste Facility Permit (SWFP) 15 AA-0150. Only nonhazardous solid wastes are permitted for disposal. The landfill is not open to the public and receives solid waste from Edwards AFB daily operations only. The landfill is unlined and does not have a leachate control system (U.S. Air Force, 2014c).

Solid waste management is a highly-regulated, costly, and necessary activity for Edwards AFB. Several management options are available to reuse, recycle, or dispose of waste while maintaining compliance with various federal, state, and local regulations that govern solid waste management. Edwards AFB is one of two Air Force bases that owns and operates a municipal solid waste landfill in California. Owning a landfill brings additional regulatory requirements and operational costs that may burden the Air Force with additional financial responsibility. However, with the high cost of closure (including permitting, physical closure, and long-term maintenance and monitoring), capital investment in the existing landfill, uncertain future of available landfill space and transportation costs, and security that comes with being self-sufficient, it may be beneficial to continue to operate the landfill despite high operational costs.

The Edwards AFB MBAL has been in operation since the mid-1970s. Management decisions to dispose of a large fraction of the waste generated at the Base at off-Base landfills along with significantly reduced operations and Base population have caused a substantial reduction in waste disposal at the MBAL, prompting Edwards AFB to question whether or not the operation of a landfill is a cost-effective waste management strategy. Edwards AFB contracted with Tetra Tech, Inc. (Tetra Tech) to prepare a comprehensive third-party study to evaluate options for solid waste management at Edwards AFB. This *Technical Feasibility Study for Integrated Solid Waste Management, Recycling, and Main Base Active Landfill at Edwards Air Force Base* (Tetra Tech and JC Palomar, 2015) (feasibility study) included an evaluation of management options

for the reuse, recycling, and disposal of waste generated on Edwards AFB to determine the options that are the most feasible and cost-effective without disruption to the Edwards AFB mission.

1.4 REGULATORY REQUIREMENTS

Currently, the landfill operates under Solid Waste Facility Permit (SWFP) No. 15-AA-0150, issued 8 December 2009 by the Local Enforcement Agency (LEA), the Kern County Public Health Services Department (KCPHSD) (formerly Kern County Environmental Health Services Department [KCEHSD]), with concurrence by the Department of Resources Recycling and Recovery (CalRecycle) (formerly the California Integrated Waste Management Board [CIWMB]). This permit also includes the operation of a 4-acre composting operation within the landfill boundary. The landfill also operates in compliance with Revised Waste Discharge Requirements (WDR), Board Order Number R6V-2002-0019, issued by the California Regional Water Quality Control Board (RWQCB), Lahontan Region, on 10 April 2002.

Regulatory requirements for closing the landfill include issuance of closure WDRs by the RWQCB pursuant to CCR, Title 27. As part of this, Edwards AFB would need to submit a complete revised report of waste discharge and final closure plan at least 120 days prior to the initiation of closure activities. At that time, potential impacts to waters subject to regulatory authority by the State of California would be identified along with appropriate Best Management Practices (BMPs) designed to minimize erosion or other impacts to drainages. Vertical expansion of the landfill would also be subject to the requirements of CCR, Title 27.

In addition, prior to issuance of any discretionary permits, the RWQCB may require compliance with the California Environmental Quality Act (CEQA). CEQA is a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. A public agency must comply with CEQA when it undertakes an activity defined by CEQA as a "project" requiring some discretionary approval from a government agency that may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment. Most activities at Edwards AFB are not subject to CEQA as they do not require any discretionary action by a state or local agency. However, the landfill is subject to permits by State and local agencies and, as such, the landfill's

SWFP was the subject of analysis and approval under CEQA. While continued operation of the landfill is not subject to further CEQA review at this time, closure or vertical expansion of the landfill may require additional CEQA review at the time that a decision on closing or expanding the landfill is made by Edwards AFB.

This Environmental Assessment is intended to help Edwards AFB evaluate the environmental impacts of various alternatives associated with managing mission-generated solid waste at the base. For the foreseeable future, the base will continue to dispose of mission-generated solid waste at the MBAL until such time that a decision is made to close or expand the landfill. When such a decision is made, additional study and permitting will be required, including the permitting identified in this section.

1.5 CURRENT EDWARDS AFB DISPOSAL CONDITIONS

Disposal at the landfill is tracked in two categories: refuse, and construction and demolition (C&D) waste. The tonnages for both categories can vary significantly from month to month; however, in the past 20 years there has been an overall steady downward trend due to increased diversion, waste streams taken off-base, and population decrease. Different policies and programs on base have also had significant impacts on the disposal tonnages. There was a concern that demolition projects were consuming landfill airspace too quickly; therefore, C&D waste from individual demolition contracts was contractually required to be hauled off base starting at the end of 2010. Military Family Housing (MFH) was privatized in October of 2013. Prior to privatization, MFH waste and recyclables were hauled to the MBAL and accepted as part of the Performance-Based Work Statement for Integrated Solid Waste Services. During contract negotiations for MFH privatization, there was a concern that the Base would not be able to provide refuse disposal services for the length of the contract (50 years); therefore, it was decided to haul all MFH refuse, recyclables, and C&D waste off-base as part of the MFH management contract.

The most recent MBAL site life estimates were done in August 2015 as part of a Joint Technical Document (JTD) update (U.S. Air Force, 2014b). Based on the average annual refuse accepted over a 5-year period, from 1 April 2009 through 31 March 2014, and an Airspace Utilization Factor (AUF) of 0.23 tons per cubic yard, the 5-year average disposal rate was calculated to be

4,352 tons per year (tons/yr). This would give the landfill an estimated life expectancy of 62.1 years and a closure date of May 2076. The lifespan estimates do not include a typical population growth factor because Edwards AFB does not have a standard growth rate like most cities or counties.

The downward trend in disposal rates has continued since the lifespan estimate for the JTD. If the more recent disposal data for fiscal year (FY) 2014 is used to calculate a new average 5-year disposal, from October 2009 through September 2014, it results in an annual average tonnage of 3,882 tons/yr. Therefore, in just six months, the five-year average annual disposal rate has decreased by 12 percent (4,352 tons/yr to 3,882 tons/yr).

Based on the trend over the past several years, it is not anticipated that the disposal rate will increase significantly in the future unless prompted by a significant new mission, weapons system, or base realignment. Without any policy or program changes, it seems likely that the disposal rate will continue to decrease and eventually level off over time.

A Technical Feasibility Study for Integrated Solid Waste Management was prepared in 2015 to assess alternatives for management of solid waste on Edwards AFB (Tetra Tech and JC Palomar 2015). In the Study, alternatives were ranked based on criteria and importance. Data and information from this report was used during preparation of this EA. A cost comparison of the alternatives selected and analyzed in this EA is provided in Appendix A, although costs were not used in the selection of the alternatives.

1.6 PURPOSE OF AND NEED FOR PROPOSED ACTION

The project proponent is the 412th Test Wing (TW), Civil Engineer Group. The purpose of the project is to establish a reasonable long-term plan for proper disposition of Base-generated solid waste in support of the Edwards AFB mission. The need is to properly process and dispose of mission-generated solid waste. The proposed action and alternatives will address the constantly changing mission, diminished solid waste stream, increased operational costs and increased regulatory requirements.

1.7 ISSUES AND CONCERNS CONSIDERED

During the scoping process, the following issues and concerns were identified as requiring assessment when considering the potential environmental impacts of the alternatives.

- **Air Quality and Greenhouse Gases.** Temporary, minor air pollutant emissions (primarily dust) would be generated during closure of the landfill, which includes construction of the landfill cap. Depending on the alternative, operational impacts (mostly truck trips) may shift from mostly on-base emissions to more off-base emissions. Expansion of landfill capacity would extend the life of the landfill but would not change emissions related to operation of the facility.
- **Cultural Resources.** The existing landfill area has been highly disturbed over years of use. However, the Base contains numerous cultural resources, some of which could be impacted during closure or changes in operation of the landfill.
- **Geology and Soils.** Depending on where the cover material for the landfill comes from, closure has the potential to involve ground-disturbing activities that may result in soil erosion.
- **Hazardous Materials and Waste.** The generation, use, handling, transportation and disposal of hazardous materials and hazardous waste may occur as a result of construction activities. Hazardous materials and waste are not currently accepted at the MBAL.
- **Infrastructure.** Potential impacts to existing roadways may occur as a result of short-term changes in traffic patterns.
- **Natural Resources.** The existing landfill area has been highly disturbed over years of use. However, the Base contains sensitive species, some of which could be impacted during closure or changes in operation of the landfill.
- **Noise.** Construction associated with closure of the landfill has the potential to result in temporary and localized minor noise impacts.
- **Socioeconomics.** Construction of the landfill cap would result in a temporary, minor increase in local employment. Closure would result in potential loss of jobs for landfill contractor personnel.
- **Hydrology and Water Quality.** Groundwater and surface water issues would continue to need to be addressed for all solid waste management options. Closure or vertical expansion alternatives may require additional regulatory permitting that would address a number of water quality-related issues including storm water diversion measures to redirect natural waterways around the landfill.

1.8 ISSUES AND CONCERNS DISCUSSED BUT NOT CONSIDERED RELEVANT FOR FURTHER ANALYSIS

The following issues and concerns were initially considered, but subsequently eliminated from analysis in this EA because they are not applicable to this project or would not result in significant impacts. Consequently, they will not be addressed in Chapters 3 and 4.

- **Airspace.** The proposed solid waste management options would not affect the management or use of the airspace at Edwards AFB or the surrounding area.
- **Land Use.** None of the solid waste management options would affect mission operations or local/regional plans and development.
- **Public Safety/Emergency Services.** Construction of the landfill cap would not affect overall public safety at the Base, nor affect emergency services at the Base.
- **Environmental Justice and Protection of Children.** The Executive Orders (EOs) on Environmental Justice and the protection of children require federal agencies to identify and address disproportionately high adverse effects of their activities on minority and low-income populations and children. Given that activities associated with all solid waste management options would occur entirely on Edwards AFB or would result in disposal at permitted off-base landfills, the Air Force has determined that this action would have no substantial, disproportionate impacts on minority and low-income populations and/or children.

1.9 PUBLIC NOTIFICATION PROCESS

Relevant federal and state resource agencies and Native American tribes, and local document repositories are on the project mailing list and have been sent notification on the Proposed Action and Alternatives. The Draft EA was filed with California Office of Planning and Research (State Clearinghouse) for distribution to appropriate State and regional agencies for review and comment. One letter from the RWQCB was received. This letter, as well as responses to the letter, are provided in Appendix D.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and Alternatives, including the No Action Alternative. The criteria established for selecting a reasonable range of alternatives are identified, as are the alternatives that were considered but dismissed from further discussion. The potential environmental impacts for each alternative are summarized in table form at the end of this chapter, as are the minimization measures proposed to ensure that all impacts are kept to a level that is not significant.

2.1 CRITERIA FOR SELECTION OF A REASONABLE RANGE OF ALTERNATIVES

The criteria established here set the minimum requirements that must be met for an alternative to be considered viable. A more detailed explanation of the process by which the alternatives were selected and evaluated with respect to these criteria is provided in the *Technical Feasibility Study for Integrated Solid Waste Management, Recycling, and Main Base Active Landfill at Edwards Air Force Base* (Tetra Tech and JC Palomar, 2015). Those alternatives not meeting one or more of the selection criteria have been eliminated from further discussion. Explanation of eliminated alternatives is provided in Section 2.2. Descriptions of each alternative considered, including the No Action Alternative, are provided in Sections 2.3 through 2.7. Alternatives meeting all selection criteria are retained and analyzed in Chapter 4 (Environmental Consequences) of this EA.

The criteria used to select the alternatives discussed in this document are described below. Selection criteria have been separated into four categories:

- Criteria which address sustainability and supportability of the Edwards AFB mission;
- Environmental criteria which address environmental considerations at the Base;
- Feasibility criteria which address technical and regulatory compliance requirements; and
- Economic considerations which address economic viability;

<u>Sustainable/Mission Support Criteria</u>

1. Provide for highest and best use of material generated by Edwards AFB.
2. Verify compatibility/consistency with mission objectives.

<u>Environmental Criteria</u>

1. Verify compliance with applicable environmental regulations and Air Force policy.
2. Provide beneficial environmental impacts.
3. Minimize impacts to sensitive biological and cultural resources.
4. Minimize long-term risk and/or provide an opportunity to improve the environment.

<u>Technical Criteria</u>

1. Verify that alternatives are technically sound and regulatory compliant.
2. Verify compatibility with existing Edwards AFB infrastructure.

<u>Economic Criteria</u>

1. Determine economic viability of alternatives.

2.2 ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER CONSIDERATION

Alternatives for management of solid waste on Edwards AFB were assessed and ranked, the results of which are provided in the *Technical Feasibility Study for Integrated Solid Waste Management, Recycling, and Main Base Active Landfill* (Tetra Tech and JC Palomar, 2015). The study considered a wide range of alternatives that were compared within specific categories: Operational, Closure, Zero Waste, and Waste-to-Energy. Additional details on the alternatives considered and the process for evaluating them is included in the Technical Feasibility Study. A brief overview is provided here.

In ranking alternatives in each category, cost (economic) was the most heavily weighted of all the decision criteria. The Operational category includes nine alternatives that were evaluated.

One of these alternatives, the enhanced use lease was considered but dismissed primarily due to the small size of the landfill and risk associated with not being in control of the waste disposal. Lateral expansion of the existing MBAL was considered but dismissed as being cost prohibitive because of requirements including a liner, a leachate collection system, potential gas collection system, and extensive permitting, design, and operational requirements. Another alternative looked at establishing a new construction and demolition (C&D) landfill on the Base. However, the relative lack of demand for such a facility, as well as the cost of siting, designing, permitting, construction, and operation of a second fully-permitted disposal facility outweigh any benefits. The remaining six operational alternatives were included in various forms in the alternatives considered below in Section 2.3 through 2.7. In particular, the off-base transport and disposal option provides the lowest per ton costs for disposal of all the alternatives considered and was given the highest score of all alternatives. Local landfills (within less than 30 miles) have significant capacity and could easily accept Edwards AFB tonnages in the foreseeable future.

The Closure category includes seven alternatives that were evaluated. Four of these alternatives (clean closure, landfill mining, phased closure, and mothballing) were considered and dismissed due to cost and risk factors. A fifth alternative, placing a solar farm over the MBAL final cover, was rejected as it presents more challenges than benefits, with additional closure costs, lower energy production on a fixed system, settlement issues, flight concerns, and probably difficulty connecting to the grid. The approved Edwards AFB Preliminary Closure Post-Closure Maintenance Plan (PCPCMP) includes a prescriptive cover design, but the alternative cover design would result in a closure cost savings of approximately 73 percent when compared to the prescriptive cover cost. Therefore, the prescriptive cover was dismissed as an alternative but the alternative cover is carried forward as an alternative for analysis.

Zero Waste and Waste-to-Energy were evaluated as their own categories. The Waste-to-Energy alternatives were considered but dismissed because of low waste generation on Edwards AFB. The Zero Waste Alternative received a relatively high score because it aligns with the increasing waste diversion regulatory requirements but was dismissed because of the cost and time required to achieve this goal. Nevertheless, reducing the overall waste stream at Edwards AFB is an on-going long-term goal.

2.3 ALTERNATIVE 1 (PROPOSED ACTION): CLOSURE OF THE MAIN BASE LANDFILL AND OFF-SITE TRANSPORTATION AND DISPOSAL

2.3.1 Overview

Landfill closure would require Edwards AFB to comply with closure and post-closure maintenance requirements as promulgated by the California Department of Resources, Recycling, and Recovery (CalRecycle) and the State Water Resources Control Board (SWRCB). In particular, as discussed in Section 1.4 (Regulatory Requirements), regulatory requirements for closing the landfill include issuance of closure waste discharge requirements (WDRs) by the Regional Water Quality Control Board (RWQCB), Lahontan Region, pursuant to CCR, Title 27. In addition, prior to issuance of any discretionary permits related to closure, the RWQCB may require compliance with the California Environmental Quality Act (CEQA). These permits and the associated CEQA document would be prepared at the time that Edwards AFB decides to close the landfill.

Closure of the MBAL could be accomplished by using either a prescriptive cover or an alternative cover design, both of which would comply with State requirements. The prescriptive cover would consist of a two-foot thick foundation layer, a one-foot (minimum) low-hydraulic conductivity layer, and an erosion-resistant layer capable of sustaining native vegetation planted during closure. The alternative cover would consist of either a geosynthetic or evapotranspiration cover, both of which would require much less soil material to be transported from off-base and, therefore, would be much less expensive to install than a prescriptive cover.

Cost estimates for a prescriptive cover and alternative cover were provided in the Feasibility Study (Tetra Tech and JC Palomar, 2015). The estimated cost to construct the final cover portion of the 27 CCR prescriptive cover is $14.8 million. The estimated cost to construct the final cover portion of the alternative ET cover is $2.8 million. Therefore, the cost savings associated with using an alternative ET cover would be approximately $12 million. There were no other changes to the overall closure cost estimate which includes drainage improvements, structure demolition, construction management, construction quality assurance (CQA), and engineering support. However, the use of an ET cover would result in an associated decrease in

the required contingency cost estimate resulting in an overall decrease in closure cost from $20.3 million to $5.5 million; a total savings of approximately $14.8 million or 73 percent. This cost estimate for an ET cover system is based on the assumptions provided below and could increase or decrease depending on the availability of soil materials. However, if only half of the above estimated cost savings could be realized, it would still be a significant savings.

Until such time that a study can be conducted to determine the viability of cover material on base (usually done while developing the closure plan, which is three years prior to closure), it is assumed that an alternative cover design (as described below) would be the preferred cover for the closed landfill.

After closure, the landfill would require regular inspection, maintenance, and monitoring activities. These activities would continue for 30 years or more after landfill closure (Title 27 CCR, Section 21180) or as long as wastes pose a threat to water quality (Title 27 CCR, Section 20390), whichever lasts longer. A cost estimate, in 2014 construction dollars, for the post-closure maintenance activities was developed as part the June 2014 Preliminary Closure and Post-Closure Maintenance Plan (PCPCMP) for the MBAL. The PCPCMP cost estimate identifies the annual post-closure maintenance costs as approximately $384,000, applied over the 30-year post closure period for a total cost of $11.5 million.

Following closure, all waste from Edwards AFB would be transported to off-base landfills for disposal. Nearby landfills (including ones in Mojave, Boron, and Lancaster) should be able to accommodate the relatively small amount of mission-related waste currently generated at Edwards AFB (less than 12 tons per day) because actual daily tonnages at nearby landfills are below their permitted maximums. Concurrent with landfill closure, the staff at the Base would continue to work to maximize reuse and recycling through such concepts as Zero Waste which would allow for reduced waste collection and transportation costs, and minimized tipping fees at off-base landfills. New recycling and waste reduction practices and technology, including Extended Producer Responsibility, Cradle to Cradle manufacturing, Green Procurement, Waste-to-Energy, and other forms of conversion technology would be monitored and evaluated for applicability and conformity with Edwards AFB policies and mission.

2.3.2 Alternative Cover Design

The goals of the final cover design are to limit water infiltration into the landfill to the greatest extent possible, isolate the wastes, promote drainage by appropriate surface grades, minimize erosion or abrasion of the cover, and accommodate settlement or subsidence while maintaining cover integrity (Tetra Tech, 2015 [PCPCMP]). The implementation of an alternative cover design could greatly reduce closure costs (compared to a prescriptive cover) by eliminating the need to source and transport the proper specification material from off-base for construction of the cover. An alternative cover design is an alternative to the prescriptive cover design required in 27 CCR, Section 21090. An alternative cover is required to perform equal to or better than a prescriptive cover.

The two most common types of alternative final covers used in California are evapotranspiration (ET) and geosynthetic. Geosynthetics are typically used as a barrier layer in lieu of clay, thereby reducing the thickness of the cap and increasing available airspace. Geosynthetics can be fairly inexpensive and easy to install; however, they require that a gas system be in place to prevent the liner from lifting under pressure from built-up landfill gas (LFG) trapped beneath the geosynthetic liner. The MBAL does not have a LFG extraction system and there are no plans to install one in the future. The addition of a LFG extraction and treatment system to support a geosynthetic cover would add significant cost and long-term operation and maintenance requirements for the MBAL. Therefore, the use of a geosynthetic cap is not recommended.

However, ET covers do not require an LFG extraction system and consist of higher permeable soils similar to those located on Base. The MBAL is a good candidate for an ET cover because it is located in a desert region with low rainfall and high evapotranspiration rates. A study was done for Site 3, the Main Base Inactive Landfill, which is located just south east of the MBAL, to determine a remedy for the underlying contamination (Tetra Tech, 2015 [JTD]). The selected remedy included an ET cover consisting of the following:

- 1 foot foundation layer (assuming 0.5 foot in place);
- 1.5 feet of low-hydraulic conductivity layer using soil with a hydraulic conductivity of 1×10^{-4} cm/sec; and

- 0.5 foot of vegetative top soil.

Based on the results of the Site 3 study, it is assumed that the same ET cover design would be adequate for the MBAL. Additional research would be needed to identify sources of soil on base, but for cost estimating purposes, it was assumed that material for the foundation layer could be found on the landfill site (or the borrow pit located immediately south of the landfill) and that the 1×10^{-4} cm/sec soil and vegetative top soil can be found within five miles of the MBAL. The vegetation layer should provide protection against erosion of the landfill cover, have shallow roots, and survive the arid climate of the site with minimum irrigation and maintenance.

2.3.2.1 Cover Design and Construction

The present design is a landfill raised above the ground. At the time of closure, the entire site would be closed with a final cover system. The final grading plan and alternative cover system will be based on site conditions at the time of closure, and Edwards AFB and regulatory agency requirements. All specifics would need to be approved at the time of closure. The final cover would be designed and constructed to function with the minimum maintenance and would provide waste containment to protect public health and safety by controlling vectors, fire, odor, litter, and potential landfill gas migration. The top of the landfill would be graded to a 3 percent slope so that water would drain off and not collect on the surface. The side slopes of the closed landfill would be at about a 3 to 1 slope (horizontal to vertical) ratio.

2.3.2.2 Stability of Final Slope Face and Landfill Settlement

Following closure of the landfill, the stability of the final exterior slope face under both static and dynamic conditions will be important. In response to a March 2008 request from the CIWMB (now CalRecycle), Edwards AFB conducted a slope stability and liquefaction potential analysis. The results of the liquefaction potential analysis indicated that the potential for liquefaction hazard at the landfill is very low. The results of the slope stability analysis indicated that the Edwards AFB Landfill final closure topography is in compliance with the requirements of CCR Title 27, Article 4, Section 21750 (5) Stability Analysis (Tetra Tech, 2014b [PCPCMP]).

The major factors contributing to landfill settlement include nature and composition of the waste, initial refuse density, content of decomposable materials in the refuse, fill height, method of construction, initial moisture content, leachate level and fluctuation, and environmental factors such as precipitation and temperature. Due to large variations in these factors and extreme heterogeneity of material composition, the settlements in one landfill could be spatially quite irregular and different from another landfill. Therefore, settlement in a landfill is difficult to predict and the applied methods only serve as an indication of the order of magnitude of potential settlement. However, the dry environment at the MBAL may drastically slow down the decay process of refuse. Settlement estimates will be made and reviewed as site-specific data become available (Tetra Tech, 2015 [PCPCMP]).

2.3.2.3 Grading, Drainage Control, and Structures

Grading

Final grading of the site would include the entire landfill boundary and may include the eastern corner of the landfill if it includes inert construction and demolition debris. This corner is outside the existing footprint and, as such, is not permitted to accept municipal solid waste but can only receive inert C&D debris such as concrete and asphalt, with appropriate approvals. The grading plan must meet the following requirements:

- Cover design as described above;
- Minimum 3 percent slopes of finished landfill surface;
- Wherever possible, uniform slopes with straight line rather than curved contours to provide an easy survey control during grading; and
- Minimum hauling of materials for foundation layer while satisfying the above criteria.

Drainage Control

Topography of the site is gently inclined to the southwest. Ground surface elevation ranges from 2,370 feet to 2,420 feet above msl. Shallow, ephemeral drainage channels approach the area from the northeast, either crossing a part of the site or ending against an earthen embankment to the northeast. The drainage channels join a larger channel (Mojave Creek dry wash) that parallels Landfill Road.

A hydrologic evaluation was conducted to establish the characteristics and quantity of surface drainage flows and off-site run-on flows. In addition, a Drainage Feasibility Study was prepared to evaluate long-term alternatives to prevent ponding and infiltration of surface water runoff at the landfill. Based on estimated volumes and rates derived from these studies as well as a site visit, five drainage alternatives were assessed. Alternatives were evaluated based on capital cost, operations and maintenance cost, area of environmental impact, risk of failure, and construction schedule. Based on these criteria, the diversion channel and infiltration alternative was selected. The design concept for site drainage has two components: (1) run-on from the upland drainage is isolated from the landfill by an interception channel that will divert the flow around the site in conjunction with two small infiltration basins, and (2) on-site runoff is maintained as dispersed sheet flow distributed to the landfill slopes. Additional detail regarding site drainage design is provided in the PCPCMP and is analyzed in Section 4.9, Hydrology and Water Quality, of this EA.

Structures

On-site structures not intended for use during post-closure would be removed at the time of closure. The ROC and composting facility located within the landfill boundary would remain in operation if it is determined to be economically feasible. Groundwater monitoring wells and gas monitoring wells that lie in the path of the final cover slope would require a vertical extension of the well casing. If in the future, other temporary structures located within the area covered by the final landfill cover exist, they would be demolished and the site would be cleaned to grade as required for the final cover system prior to construction of the final cover. A cased test boring exists at the site. This test boring would be decommissioned prior to or during closure activities.

2.3.2.4 Groundwater Monitoring Plan

The Edwards AFB detection monitoring program has been in operation since 1993. The program is conducted in accordance with RWQCB Monitoring and Reporting Program (MRP) R6V-2002-0019 issued on 10 April 2002. Seven point of compliance detection groundwater monitoring wells (4-MW02, 4-MW03, 4-MW04, 4-MW06, 4-MW07, 4-MW08, and 4-MW09),

one background well (4-MW10), and one auxiliary background well (4-MW-11) are monitored quarterly in compliance with MRP R6V-2002-0019 (Tetra Tech, 2015 [PCPCMP]).

According to the 2013 monitoring data, constituents have been detected at levels above California Health Services maximum contaminant levels (MCLs). Edwards AFB is currently in agreement with the RWQCB to continue to monitor contaminant levels for natural attenuation and further evaluate the landfill monitoring network and identify the source of the MCL exceedances only if the contaminant concentrations do not continue to trend downward as expected. Currently, it has been suggested that exceedances in contaminant concentrations may be due to well construction materials, and natural occurrences caused by soil and bedrock formations and releases of potable water in the area. An evaluation of the landfill exceedances and monitoring network was submitted to the RWQCB in early 2014. The monitoring and reporting program would continue throughout the closure period, the post-closure maintenance period (not less than 30 years, as per Title 27 CCR, Section 21180), and during any compliance period under Title 27 CCR, Section 20410 (RWQCB 2002) (Tetra Tech, 2015 [PCPCMP]).

There is no existing leachate collection and removal system for the landfill. Leachate has not been identified to date. If results of the detection monitoring program indicate a measurable significant release of contamination from the landfill, Edwards AFB will conduct an investigation to verify the presence or absence of leakage from the landfill; the establishment of a corrective action program if it is found that water quality protection standards have been exceeded; and the continuation and/or amendment of the corrective action program to provide compliance with water quality protection standards (Tetra Tech, 2015 [PCPCMP]).

2.3.2.5 Landfill Gas Monitoring

Title 27 CCR, Section 20921 through 20934 details the gas monitoring requirements at active and closed disposal sites. The perimeter landfill gas monitoring network has been installed as required by Title 27 CCR, Section 20923 (Plate 1). The monitoring network consists of 10 wells (4-LFG10, 4-LFG11, 4-LFG12, 4-LFG13, 4-LFG14, 4-LFG15, 4-LFG16, 4-LFG17, 4-LFG18, and 4-LFG19) installed along the landfill perimeter. All wells were installed in compliance with the monitoring network design criteria provided in Title 27 CCR, Section 20925. To date, no

methane has been detected in any of the wells or structures monitored (Tetra Tech, 2015 [PCPCMP]).

In addition, the RWQCB has monitoring requirements for gases that could potentially impact water quality and are outlined in the WDRs and MRPs for each individual landfill. The RWQCB landfill gas monitoring program is conducted in accordance with the vadose zone monitoring requirements in MRP R6V-2002-0019 (RWQCB 2002). The program includes sampling and analysis of six gas monitoring wells (4-LFG02, 4-LFG03, 4-LFG04, 4-LFG07, 4-MW08, and 4-MW09) quarterly for methane, annually for other fixed gases, and annually for VOCs. Monitoring results are included in the quarterly and annual reports submitted to RWQCB (U.S. Air Force 2014). No regulatory limits are set for VOCs detected in landfill gas monitoring wells (Tetra Tech, 2015 [PCPCMP]).

The Edwards AFB landfill is exempt from the federal guideline requirements for a gas collection system. At present, the available data do not indicate any landfill gas migration above acceptable levels from the landfill site, and no landfill gas collection system is planned at this time.

2.3.2.6 Post-Closure Land Use and Maintenance

The PCPCMP provides for closure and post-closure maintenance of the landfill as an open space area. The site would be graded to harmonize with the setting and landscaped with drought-resistant vegetation. The vegetation that has been selected requires minimum irrigation and maintenance. The ROC and composting facility would remain in operation if it is determined to be economically feasible.

After the closure construction of the landfill site has been completed; inspection, maintenance, and monitoring activities would be performed on a regular basis. These activities would continue for 30 years after the landfill closure (Title 27 CCR, Section 21180) or as long as wastes pose a threat to water quality (Title 27 CCR, Section 20390) whichever lasts longer. They are designed to maintain long-term environmental control and monitoring systems, and integrity of the site. A description and estimated cost of carrying out these activities over the

post-closure maintenance period are provided in the PCPCMP. At Edwards AFB, Civil Engineering is primarily responsible for operations, repairs, and maintenance. Environmental Management acts in an advisory capacity and provides inspection, monitoring, and permitting support.

The following items would be inspected and maintenance carried out as appropriate over the post-closure maintenance period by the landfill operator:

- Landfill cover maintenance and integrity including cracking, subsidence, vegetative cover growth, rodent burrows, and erosion;
- Drainage system;
- Groundwater monitoring wells;
- Gas monitoring wells; and
- Site security including fencing, gates, and signs.

2.3.3 Off-Site Transportation and Disposal

With closure of the MBAL, all remaining waste from Edwards AFB (non-MFH waste) would need to be collected from on base and then transported off base. The existing costs associated with refuse collection and rolloff staging and collection were maintained. An off-base hauling cost of $22 per ton and tipping cost of $50 per ton, for a total cost of $72 per ton, was assumed based on actual costs from the MFH contract. The $50 per ton is a conservative estimate, since the posted tipping fee at the two closest landfills, Boron and Mojave-Rosamond Sanitary Landfills, is $45 per ton. Off-base transport and disposal of non-MFH waste generated at Edwards AFB is estimated to cost $497,247 annually or $170 per ton assuming a disposal rate of 2,918 tons per year. This scenario also assumes that the MBAL would be closed and that post-closure maintenance costs of approximately $384,000 per year would be incurred by Edwards AFB. The post-closure maintenance costs include maintenance of the prescriptive final cover, erosion control, landfill gas monitoring and well maintenance, groundwater monitoring and well maintenance, drainage improvements, access and security, and site administration and are based on third party rates in accordance with 27 CCR (U.S. Air Force 2014c; Appendix C). If post-closure maintenance costs are added to the off-base transport and disposal scenario, the estimated cost would then be approximately $881,247 annually or $302 per ton.

The difference between the existing condition ($388 per ton) and the off-base transport and disposal scenario ($170 per ton) is $218 per ton if post-closure maintenance costs for the MBAL are not included; if included the difference is then $86 per ton. In either case, it can be concluded that off-base transport and disposal of non-MFH waste generated at Edwards AFB is more economical than landfilling at the MBAL.

2.4 ALTERNATIVE 2: CLOSURE OF THE MAIN BASE LANDFILL AND USE OF AN ON-BASE TRANSFER STATION

Closure of the MBAL would be as described in the previous section (Section 2.3), but instead of hauling all waste directly to off-base landfills, the waste would be brought to the MBAL site for sorting and consolidation before transfer and final disposal off base.

Transfer stations provide the capability of consolidating materials from smaller waste collection trucks into vehicles with higher capacities, thus conserving energy and minimizing vehicle trips to a disposal or recycling facility. Once the materials are consolidated, they can be delivered to a materials recovery facility (MRF), recycler, or to a distant landfill. Edwards AFB generated a total of 2,918 tons of Municipal Solid Waste (MSW) (excluding waste from MFH) in FY 2014, which is an average of less than 12 tons collected per day assuming 260 collection days per year (five days a week). Assuming that each waste collection truck has the capability of hauling an average of 6.5 tons per load, it would require no more than two trucks per day to collect MSW from Edwards AFB. Obtaining a permit to operate a limited volume transfer station that can receive less than 15 tons per day would be relatively easy; it only requires a notification with no discretionary action. The existing bailer building provides enough room for tipping and loading of waste and could be used as a transfer station. In addition, maintaining a transfer station along with the recycling center would facilitate some sorting and recovery of recyclables from the waste stream.

Transfer trucks hauling waste from a transfer station to a landfill have an average capacity of 20 tons. It would require about a day and a half to consolidate enough waste from Edwards AFB to fill a single transfer truck unless waste from other parts of the Base not currently buried at the landfill were also consolidated at the transfer station. The distance from Edwards AFB to the

nearest landfill, Boron Sanitary Landfill, is approximately 22 miles. Adjacent active landfills, including Boron and Mojave-Rosamond Sanitary Landfills, have over 100 years of disposal capacity and could easily accommodate the quantity of waste generated by Edwards AFB.

If the transfer station were operated by on Base personnel, implementation of this alternative would also require operators for both pieces of equipment. The cost of operators would be relatively expensive for such a small quantity of waste. Even if a contractor were hired to run the transfer station, the costs would likely be fairly high, again due to the small quantity of waste being processed.

Due to the relatively small amount of waste generated and the close proximity to active landfills, it was determined that operation of a transfer station at the Edwards AFB Landfill would be significantly more expensive than hauling waste directly off base. However, it does have the advantage of allowing the Base to do more source recycling prior to waste being hauled off Base.

2.5 ALTERNATIVE 3: FEWER OPERATING DAYS

Another alternative to address the decreasing waste generation rate at Edwards AFB would be to reduce operating costs by reducing operating days to three times per week. The operational assumption is that it would be difficult to hire a contractor to operate a remote facility like the MBAL on a part-time basis. Therefore, to operate the landfill less than five days per week would require the operation to be performed by in-house personnel. In 2008, Edwards AFB evaluated the possibility of using in-house personnel to operate the landfill and completed a cost estimate to accomplish this. The in-house operation cost evaluation was based on the labor, equipment, supply, training, and maintenance requirements presented in the MBAL Joint Technical Document (JTD). A 2008 estimate was used as a basis and the 2014 costs were determined to be about $1.54 million. The operations and collection cost was calculated to be $1.88 million (about 40 percent of which is labor cost) in 2008 dollars. Reducing operating days would mainly impact the labor cost with limited to no effect on equipment, supplies, training and certification, and equipment maintenance and parts. However, since the MBAL is accepting less waste in 2014 than it was in 2008, it was assumed that some other costs would be reduced as well, resulting in a total operating cost of $1.43 million in 2008 dollars. Applying a CalRecycle

escalation factor to that total yields $1.54 million in 2014 dollars for the Base to operate the landfill.

The current cost of the landfill operations contract is $1.46 million in 2014 dollars. The main reason for the costs being higher using Base personnel is because new equipment would need to be used thereby losing the cost savings that most contractors have. In addition, the cost effectiveness of using the equipment only three days a week instead of five is reduced because the same equipment is being used less for essentially the same costs (minus fuel and a little bit of maintenance) and less production.

2.6 ALTERNATIVE 4: VERTICAL EXPANSION OF THE MAIN BASE ACTIVE LANDFILL

The MBAL currently has an estimated life expectancy of 62.1 years and closure date of May 2076; therefore, an expansion is not critical at this time. However, if the capacity of the landfill could be expanded with minimal cost, the additional airspace may have significant value in the future. Lateral expansion has been determined to be cost prohibitive, but vertical expansion could be accomplished fairly easily and would extend the life expectancy of the landfill. Vertical expansion could also be used to accommodate additional waste at the MBAL, whether it be C&D waste that is currently being sent off base or waste from a new source such as a new group or squadron coming to the Base or from Air Force-related uses off base that may be looking for a landfill for their waste (such as Plant 42 waste).

A vertical expansion of the MBAL was approved in 2009. At that time, there was a concern with the MBAL site life because large demolitions projects had resulted in high C&D acceptance rates. Since then, C&D waste has been diverted off-base, overall tonnages are down, and the closure date is in the distant future, delaying the need for another expansion. A vertical expansion would require a permit revision subject to the requirements of CCR, Title 27 with updated final grading plans, capacity calculations, site life, and fill sequencing plan. The permitting process is fairly straight forward and may also require compliance with CEQA.

There are local Air Pollution Control District (APCD) rules that would limit the extent of a vertical expansion. Eastern Kern APCD Rule 422.1 requires any MSW landfill having a design capacity equal to or greater than 2.5 million megagrams or 2.5 million cubic meters, whichever is less, to have a site specific gas collection and control design. As described in the PCPCMP (Tetra Tech, 2015), a landfill gas collection system is not currently planned for the MBAL because of the low to non-existent methane levels historically seen at the landfill. Because a landfill gas collection system could have a significant installation and long-term operation and maintenance costs, the landfill design capacity should be kept below the APCD limits.

As part of the Feasibility Study (Tetra Tech, 2015), Tetra Tech calculated how much capacity could be added to the landfill while staying below the APCD limits for a gas collection system. These calculations were based on the 2.5 million cubic meter limit because it is the most restrictive requirement. The APCD does not define design capacity; therefore, it was assumed that the 2.5 million cubic meters refers to refuse capacity and not total capacity. The total permitted capacity for the MBAL is 3,287,337 CY. To compare the APCD limit to the MBAL, the APCD refuse capacity limit was converted to CY (3,269,877 CY). Assuming a waste to cover ratio of 3-to-1 yields an APCD total capacity limit of 4,359,835 CY. A 3-to-1 refuse to cover ratio is a standard ratio for most landfills, but it is a conservative assumption for a small landfill like the MBAL. Subtracting the total landfill capacity from the APCD total capacity limit yields 1,072,498 CY of total capacity which could be added to the MBAL to match the APCD limit. Dividing this number by the MBAL top deck area yields a maximum potential vertical increase of 12.11 feet. Therefore, a vertical expansion must be less than 12.11 feet to stay under the APCD limit. The landfill could easily expand another 10 vertical feet (the height of a typical lift) and be under the APCD refuse capacity limit.

The 10-foot vertical expansion would provide approximately 885,000 CY of additional airspace and 70 years of additional site life, based on the historically low FY 2014 disposal rate of about 10 to 12 tons per day. For comparison, if the landfill were to accept the permitted maximum of 350 tons per day, the landfill life would only be extended by 2.8 years with the vertical expansion.

Adding 70 years of site life to a landfill with a 60-year lifespan is not necessary in the short term. However, this alternative may be more viable if there were substantial changes in operations at the Base requiring additional landfill capacity. For example, if C&D waste were to be disposed of at the MBAL (instead of being diverted off base) and mission-related activities at the Base were significantly increased, landfill site life could be substantially shortened. Even so, overall waste generation rates are down and this would likely result in the landfill site life going back to something similar to what it was before 2008.

For purposes of analysis in this EA (particularly for the air quality analysis), it is assumed that under this alternative, the amount of waste generated at the base would double from an estimated average of 4,352 tons per year to 8,704 tons per year. This amount is still well below the currently permitted tonnage, which is discussed in more detail in Section 2.7, Alternative 5: No Action Alternative.

2.7 ALTERNATIVE 5: NO ACTION ALTERNATIVE

The CEQ regulations require inclusion of a No Action Alternative in an EA. The No Action Alternative serves as a baseline against which the impacts of the Proposed Action and Alternatives can be evaluated.

Under the No Action Alternative, the MBAL would remain under contractor operation until the closure date was reached. The operation costs would remain similar to current conditions and the waste acceptance rate would continue to fluctuate with changing mission requirements and increased diversion efforts. At some point in the future, the landfill would be closed, in a process similar to the one described above.

The MBAL operates under Solid Waste Facility Permit (SWFP) No. 15-AA-0150, issued by the Kern County Public Health Services Department on 8 December 2009. The SWFP is supported by the JTD, dated June 2014, that describes the facility design and operation (U.S. Air Force 2014b). The MBAL also operates in compliance with revised Waste Discharge Requirements (WDR), Board Order Number R6V-2002-0019, issued by the California Regional Water Quality Control Board (RWQCB), Lahontan Region, on 10 April 2002. The waste collection and landfill

operations contracts are overseen by the 412th Civil Engineer Squadron, Contract Services Section (412 CES/CEOES) and regulatory compliance aspects of the operation are the responsibility of 412th Civil Engineer Group, Environmental Management Division, Compliance Branch (412 CEG/CEVC) (Tetra Tech and JC Palomar, 2015).

Waste management on Edwards AFB is conducted using a variety of methods for on-base and off-base reuse, recycling, and disposal. MSW and recyclable material generated by industrial operations on Edwards AFB are managed primarily using the MBAL, ROC, and composting operation. MSW and recyclable materials generated by the privately operated MFH is hauled off-base for disposal and recycling. The majority of construction and demolition (C&D) waste is also hauled off-base for disposal and/or recycling by C&D contractors pursuant to contract requirements (Tetra Tech and JC Palomar, 2015).

2.7.1 Main Base Active Landfill Disposal

The MBAL is the disposal site for MSW from the industrial/commercial sector, military, government employees, and contractors that routinely perform work on the base. The waste received at the MBAL consists of commercial, industrial, and C&D debris. The MBAL does not accept designated waste, hot ashes/burning material, hazardous waste, untreated biohazardous waste, liquid wastes, or non-hazardous waste that requires special handling (U.S. Air Force, 2014a).

The MBAL is operated by the 412 TW and is located on USAF-owned land. The MBAL encompasses 137 acres, which include a 60.5-acre active disposal area. The remaining 76.5-acre area includes an area for the recycling operations center (ROC), a 4-acre composting facility/grinder operation, the baler building, weigh scales, the MBAL office, an inactive waste disposal cell, and vacant land (U.S. Air Force, 2014a).

The MBAL is classified as a Category 1, Class III MSW Disposal Site and is operated under SWFP #15-AA-0150. Only non-hazardous solid wastes are permitted for disposal. The MBAL is not open to the public and receives solid waste from Edwards AFB operations only. The MBAL is unlined and does not have a leachate control system because it is an existing, unlined,

Class III landfill that does not accept sewage or water treatment sludge. The maximum permitted disposal quantity is 350 tons per day of MSW and 160 tons per day of green waste and a maximum permitted traffic volume of 100 vehicles per day. Operating requirements and conditions for the MBAL are contained in the SWFP (U.S. Air Force, 2014a). These permitted amounts are well above the current historically low rates of closer to 10 to 12 tons per day, and the minimal number of associated traffic trips per day. Waste collection at the Base currently consists of 1 vehicle for collection, two roll-off vehicles, and 1 to 2 vehicles for recycling. Waste is collected from throughout the developed portions of the Base, with all waste brought to the MBAL.

Waste is disposed of at the MBAL via two methods: above-grade balefill and area fill. The majority of residential and commercial waste is collected by commercial haulers. However, access is also provided to Base personnel/residents in privately owned vehicles (POVs) and government owned vehicles (GOVs). Construction and demolition waste (C&D) is trucked to the landfill by private construction contractors working on the Base, although most of that waste is now being hauled off Base.

2.7.1.1 Balefill Operations

For balefill operations, base contract haulers deliver residential and commercial waste to the baler building after passing the weigh scales and load inspection. The trucks back into the baler building and dump their loads on the tipping floor in front of the conveyor pit. The waste is back-dragged with a loader into a thin lift so it can be inspected for hazardous waste, aerosol cans, and other prohibited items. These items are removed if they are detected by the loader operator. The conveyor is then loaded using the loader. Once the waste is on the conveyor belt, it is transported to the baler feed chamber. Finished bales are created approximately once every 5 minutes, providing the waste is continuously fed into the chamber. The finished bales are ejected from the baler for transport to the balefill. The finished bales measure approximately 31 by 46 by 61 inches and weigh approximately 1,700 pounds (Edwards AFB 2015e).

After enough bales are created to fill a dump truck (approximately 6 bales), they are transported to the balefill. The dump truck is unloaded at the active face of the balefill and the bales are

stacked using either a loader or a forklift. The bales are stacked on the active face to eliminate voids within the cell that may harbor rodents. No waste is stored on the tipping floor overnight, which minimizes odor and vector problems at the site. Waste remaining in the bale chamber of the baler at the end of the day may be stored in the chamber until the following day.

Base residents may unload waste in the baler facility by driving their vehicles onto the tipping floor under the direction of the baler facility staff. Waste is manually unloaded on the tipping floor for baling.

Balefilling occurs in rows constructed over the previous below-ground cells. Once balefilling reaches the boundary of the landfill, additional layers of rows may be constructed until the final elevation of the fill area of the active landfill is reached.

2.7.1.2 Area Fill Operations

Trucks and private vehicles carrying C&D and residential and commercial waste not to be baled are directed to the active area fill location after inspection and weighing at the entrance gate. Unloading of the waste is confined to as small an area as practical. The unbaled and C&D waste delivered to the active face is spread and compacted in layers with repeated passages of landfill equipment to eliminate voids within the cell that may harbor rodents. The loose layer does not exceed a depth of approximately 2 feet before compaction. Spreading and compaction are accomplished as rapidly as practical. The northeast corner of the landfill has previously been designated for area fill C&D disposal. This area may still be used for CDW disposal pending LEA notification (Edwards AFB 2015e).

Area fill may occur interspersed with balefill or in specific areas, depending on operational needs during the life of the landfill. The landfill areas used for only area fill landfilling may be developed in rows approximately 30 feet wide and 9 feet tall. When one row is complete, the adjacent row may be initiated.

2.7.2 Recycling Operations Center (Clean Materials Recovery Facility [MRF])

The ROC is located on the south boundary of the landfill, east of the main entry gate, adjacent to and east of the baler building. Recyclable materials are delivered to the ROC from the industrial area collection program, individual drop-offs by base personnel in POVs, and the landfill screening program. Recyclable materials from the residential curbside collection program are currently transported off Base. Materials currently accepted include aluminum, steel, glass, plastic (#1 through #7), mixed paper, newspaper, white paper, cardboard, and non-automotive lead/acid and household batteries. Materials are sorted at the ROC using a combination of mechanical and manual separation techniques, to include a clean MRF (Edwards AFB 2015e).

2.7.3 Composting Facility

Edwards AFB has a permitted composting facility, the feedstock for which is generated by a grounds maintenance contract (U.S. Air Force 2014a). The composting facility is located on a 4-acre parcel within the landfill boundary in the northwest portion of the landfill. The maximum site capacity is 10,000 cubic yards (CY) total for feedstock and active compost; however, based on historical data, the annual operation only processes approximately 3,500 CY. The composting operation is currently minimally active due to a lack of available feedstock.

2.8 SUMMARY OF ENVIRONMENTAL IMPACTS

Table 2-1 presents a summary of anticipated environmental impacts for all alternatives.

Table 2-2 presents a compilation of the avoidance and minimization measures proposed to reduce impacts to a level that is not significant

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Table 2-1 - Summary of Potential Environmental Impacts

Resource	Alternative 1 Landfill Closure	Alternative 2 Transfer Station	Alternative 3 Fewer Operating Days	Alternative 4 Vertical Expansion of the MBAL	Alternative 5 No Action
Air Quality & Greenhouse Gases	Construction and operational emissions would be well below significance thresholds and would not be significant. Incorporation of minimization measures MM AQ-1 and MM AQ-2 to minimize fugitive dust emissions and to ensure compliance with state off-road regulations would further reduce air quality and greenhouse gas emissions.	Fewer impacts than Alternative 1.	No change from current conditions.	Construction and operational emissions would be well below significance thresholds and would not be significant. Incorporation of minimization measures to minimize fugitive dust emissions and to ensure compliance with state off-road regulations would further reduce air quality and greenhouse gas emissions.	No change from current conditions.
Cultural Resources	The waste footprint as well as the supporting landfill activities area would not expand beyond current boundaries with this alternative, with the possible exception of the construction of drainage features that would divert storm runoff around the landfill. The project site is mostly enclosed by a fence and the entire area is disturbed by existing landfill activities. After closure, the landfill would require regular inspection, maintenance, and monitoring activities. Because, the landfill area has already been extensively disturbed by ongoing landfill activities, and minimal new areas would be disturbed, it is unlikely that there would be any impacts to cultural resources with this alternative. There is a small potential for inadvertent discoveries during final grading of the site and closure activities. However, with incorporation of minimization measure (MM) CUL-1, no impacts to cultural resources are anticipated.	Same impacts as for Alternative 1.	No change from current conditions.	No change from current conditions.	No change from current conditions.
Geology & Soils	No significant impacts related to geology or seismicity would occur and no mitigation measures are required. There is the potential for wind or water erosion of soil to occur at the landfill. With incorporation of MM GEO-1, these impacts would be kept to a level that is not significant.	Same impacts as for Alternative 1.	No change from current conditions.	No change from current conditions.	No change from current conditions.
Hazardous Materials & Hazardous Waste	No significant impacts related to hazardous materials or hazardous wastes would occur. For this alternative, the MBAL would be closed in accordance with current State of California requirements and, following closure, all waste from Edwards AFB would be transported to off-base landfills for disposal. The closed landfill would be subject to regular inspection, maintenance and monitoring. In addition, closure would not mobilize existing contaminants associated with MBAL Site 4 in groundwater, or expose workers to contaminated soils or groundwater at levels in excess of those permitted by federal and state law. Hazardous materials necessary for	Same impacts as for Alternative 1.	No change from current conditions.	No change from current conditions.	No change from current conditions.

Table 2-1 - Summary of Potential Environmental Impacts

Resource	Alternative 1 Landfill Closure	Alternative 2 Transfer Station	Alternative 3 Fewer Operating Days	Alternative 4 Vertical Expansion of the MBAL	Alternative 5 No Action
Hazardous Materials & Hazardous Waste (continued)	project implementation that require temporary storage at the construction area would comply with relevant Edwards AFB requirements. Incorporation of MM HAZ-1 would further reduce potential hazards to workers from hazardous materials or hazardous waste during landfill closure activities to a level that is not significant.				
Infrastructure	Negligible impacts to infrastructure would occur. There would be a long-term, minor decrease in the need for infrastructure utilities, and there would be a long-term increase in vehicular traffic off the Base due to transport of materials from the MBAL to an off-Base landfill. No significant impacts to infrastructure would occur and, therefore, no mitigation or minimization measures would be required.	Negligible impacts.	Negligible impacts.	Negligible impacts.	No change from current conditions.
Natural Resources	No native vegetation or wildlife communities would be directly removed, nor sensitive species directly affected because the landfill area has already been disturbed by existing landfill activities and is surrounded by a fence, and all closure activities at the MBAL would take place within the already fenced area. Construction and monitoring activities associated with the landfill closure could have direct and temporary impacts to nesting birds, including possibly burrowing owls and other sensitive bird species, considered a significant impact if they were in violation of the federal MBTA. Implementation of MM NR-1 would avoid these impacts.	Same impacts as for Alternative 1.	No change from current conditions.	Same impacts as for Alternative 1.	No change from current conditions.
Noise	Negligible noise impacts would occur. Noise would primarily result from vehicles used during the transport of soil for constructing the landfill cover and from hauling waste from the Base that would need to be collected and then transported off Base. Post-closure noise would be related to activities required for the maintenance of the prescriptive final cover and erosion control, landfill gas monitoring and well maintenance, groundwater monitoring and well maintenance, drainage improvements, access and security, and site administration. All impacts would be negligible and not significant.	Negligible impacts.	Negligible impacts.	Negligible impacts.	No change from current conditions.
Socioeconomics	Negligible socioeconomic impacts would occur. Closure of the landfill would not create significant impacts to socioeconomics in the on- or off-base region, although it would generate a very small number of temporary jobs, which would be a beneficial impact on economic conditions in the area. A very slight increase in local revenues would be expected to occur as a result of money spent for construction materials and daily services. This increase would not measurably affect housing or schools in the area.	Negligible impacts.	Negligible impacts.	Negligible impacts.	No change from current conditions.
Hydrology/Water Quality	Closure of the MBAL has the potential for impacting local water quality due to wind and water erosion. Sporadic heavy rainfall events that occur in the vicinity of Edwards AFB can result in brief episodes of surface runoff in shallow erosion gullies and depressions in the ground surface. Run-on to the landfill area, regionally from the northeast to the southwest, may reach the landfill/balefill. This run-on would be diverted around the in-place waste with daily cover material.	Same impacts as for Alternative 1.	No change from current conditions.	Same impacts as for Alternative 1.	No change from current conditions.

Table 2-1 - Summary of Potential Environmental Impacts

Resource	Alternative 1 Landfill Closure	Alternative 2 Transfer Station	Alternative 3 Fewer Operating Days	Alternative 4 Vertical Expansion of the MBAL	Alternative 5 No Action
Hydrology/Water Quality (continued)	To prevent post-closure run-on of storm water from impacting the landfill area during and following a major rainfall event, a drainage interception system along the northeastern side of the balefill and the existing landfill has been proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road (U.S. Air Force 2014b). The system, designed to handle a 100-year, 24-hour storm, would collect off-site run-on from the upland drainage by use of interception channels that would divert the flow around the site. Closure of the landfill would be subject to the requirements of Air Force Instruction 32-1067, Water and Fuel Systems and Title 27 CCR, Section 20365, and may include future preparation of a Storm Water Pollution Prevention Plan (SWPPP) or National Pollutant Discharge Elimination System (NPDES) permit, as identified in MM HYD-1. Impacts to riverine systems in proximity to the landfill would be avoided where feasible. This includes keeping equipment staging areas in upland areas outside stream channels. Best Management Practices (BMPs) to reduce impacts from erosion to water quality would be identified in the closure WDR permit. Some generic BMPs may include: silt fences, fiber rolls, sediment/infiltration basins, and hydroseeding/vegetation establishment. Implementation of **MM HYD-1** and **MM HYD-2** would reduce potential water quality impacts from the project due to erosion to a level that is not significant.				

Table 2-2 - Summary of Minimization Measures	
Resource	**Measures to Minimize or Reduce Impacts**
Air Quality & Greenhouse Gases	**MM AQ-1**: The following dust control measures are required to be implemented during land preparation, excavation and/or demolition: • All soil excavated or graded should be sufficiently watered to prevent excessive dust. Watering should occur as needed with complete coverage of disturbed soil areas. Watering should be a minimum of twice daily on unpaved/untreated roads and on disturbed soil areas with active operations. • All clearing, grading, earth moving and excavation activities should cease during periods of winds greater than 20 miles per hour (mph) (averaged over one hour), if disturbed material is easily windblown, or when dust plumes of 20% or greater opacity impact public roads, occupied structures, or neighboring property. • All fine material transported off site should be either sufficiently watered or securely covered to prevent excessive dust. • All haul trucks should be required to exit the site via an access point where a gravel pad or grizzly has been installed. • Stockpiles of soil or other fine loose material shall be stabilized by watering or other appropriate method to prevent wind-blown fugitive dust. • Once initial leveling has ceased, all inactive soil areas within the construction site should either be seeded and watered until plant growth is evident, treated with a dust palliative, or watered twice daily until soil has sufficiently crusted to prevent fugitive dust emission. • On-site vehicle speed should be limited to 15 mph. • All areas with vehicle traffic should be paved, treated with dust palliatives or watered a minimum of twice daily. • Streets adjacent to the project site should be kept clean and accumulated silt removed. **MM AQ-2**: The following measures should be implemented to control construction vehicle tailpipe emissions: • Properly maintain and tune all internal combustion engine powered equipment; • Require employees and subcontractors to comply with the CARB idling restrictions for compression ignition engines; and • Use California ultra-low sulfur (CARB) diesel fuel.
Cultural Resources	**CUL-1:** Although the areas to the west, south, and east surrounding the MBAL have been previously surveyed for archaeological resources, those surveys are now over 10 years old and areas that may be affected by closure of the landfill will require re-survey. The area to the north of the MBAL has never been surveyed for archaeological sites. Therefore, up to approximately 300 acres of archaeological survey will need to be conducted on the west, north, and east sides of the MBAL including areas that may be affected by construction of drainage features associated with closure activities. If avoidance of any newly recorded archaeological sites is not feasible then those sites will be subject to evaluation to determine their eligibility to the National Register and subsequent treatment in accordance with Section 106 of the National Historic Preservation Act. In the unlikely event that subsurface archaeological resources are discovered, work will cease immediately in the area and the Base Historic Preservation Officer (BHPO) will be contacted. A records search for any landscapes or traditional cultural properties will also be conducted by contacting the Native American Heritage Commission as well as the four federally-recognized tribes affiliated with Edwards AFB.
Geology and Soils	**GEO-1:** Controls such as the use of water to reduce dust and stormwater control devices such as the installation of a drainage interception along the northeastern side of the balefill and the existing landfill is proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road. The system, designed to handle a 100-year, 24-hour storm, would collect off-site run-on from the upland drainage by use of interception channels that will divert the flow around the site (Edwards AFB 2015a).

Table 2-2 - Summary of Minimization Measures

Resource	Measures to Minimize or Reduce Impacts
Hazards and Hazardous Materials	**HAZ-1:** Prior to construction activities associated with the landfill closure, a health and safety plan in compliance with 29 CFR 1910.120 will be prepared and approved by Edwards AFB. The site-specific health and safety plan will address all site-specific safety and environmental hazards that have the potential to be encountered during construction of the alternative, including physical hazards, biological hazards, and general safety hazards. Any training required by construction personnel will be identified.
Infrastructure	No minimization or mitigation measures would be required.
Natural Resources	**NR-1:** Pre-construction surveys will be conducted during nesting season to ensure compliance with the federal MBTA and avoid nesting impacts to burrowing owls and other bird species. These surveys will be conducted no more than 5 days in advance of initial disturbance. If the project impacts are to occur during the breeding season and owls or nesting birds are found occupying habitat within the disturbance area, disturbance of nests will not occur when active nests contain eggs or fledglings. If the project impacts are to occur outside of the breeding season and owls or other nesting birds are found occupying habitat within the disturbance area, passive relocation (via one-way doors and collapse of burrows) will occur. If no active nests are found within the disturbance area during the pre-construction surveys, the proposed disturbance activities may proceed.
Noise	No minimization or mitigation measures would be required.
Socioeconomics	No minimization or mitigation measures would be required.
Water Resources	**HYD-1**: The selected alternative may require a Storm Water Pollution Prevention Plan (SWPPP) in support of a National Pollutant Discharge Elimination System (NPDES) permit in connection with closure activities. Implementation of a SWPPP would ensure downstream water quality as sediment erosion would be controlled and sediment movement from the proposed alternative during construction would be reduced. **HYD-2**: The selected alternative will require issuance of closure WDRs by the RWQCB pursuant to CCR, Title 27 to identify potential impacts to regulated waters as well as associated impact minimization measures. Where feasible, impacts to regulated waters would be avoided and BMPs for reducing erosion impacts to water quality would be identified and implemented.

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3.0 AFFECTED ENVIRONMENT

This chapter describes existing environmental conditions likely to be affected by the Proposed Alternatives, including the No Action Alternative. It provides the baseline information that was used to identify and evaluate potential environmental changes resulting from the implementation of the Proposed Alternatives. Resources identified that may be affected by the project include air quality and greenhouse gases, cultural resources, geology and soils, hazardous materials and hazardous waste, infrastructure, natural resources, noise, socioeconomics, and hydrology and water quality.

3.1 AIR QUALITY AND GREENHOUSE GASES

The Main Base at Edwards AFB is located in the eastern portion of Kern County, but portions of the Base extend to Los Angeles County in the south and San Bernardino County in the east. Eastern Kern County is located on the western edge of the Mojave Desert and is separated from populated valleys and coastal areas to the west and south by several mountain ranges. These valleys and coastal areas contain the major source of ozone precursor emissions affecting ozone exceedances within Kern County's part of the Mojave Desert Air Basin (MDAB). The Eastern Kern County region is largely impacted by ozone transport from both the San Joaquin Valley Air Basin and the South Coast Air Basin. Elevated levels of particulate matter are primarily associated with fugitive dust, which is produced through a combination of high winds, dry soil conditions resulting from an arid climate, and ground-disturbing activities such as mining, agriculture, and construction.

All alternatives would take place within Kern County. The Kern County portion of the Base is under the jurisdiction of the Eastern Kern Air Pollution Control District (EKAPCD) who is responsible for local air quality.

3.1.1 Air Quality

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. By comparing a pollutant concentration in the atmosphere to federal and/or state ambient air quality standards, the significance of its presence can be determined.

Pursuant to the Federal Clean Air Act Amendments of 1990 (CAA), the United States Environmental Protection Agency (USEPA) has established National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The NAAQS are classified as primary and secondary standards. Primary standards prescribe the maximum permissible concentration of pollutants in the ambient air and are required to protect public health. Secondary standards specify the levels of air quality required to protect public welfare, including materials, soils, vegetation, and wildlife, from any known or anticipated adverse effects. NAAQS are established for six pollutants (known as criteria pollutants): ozone (O_3), particle pollution (i.e., respirable particulate matter less than 10 microns in diameter [PM_{10}] and respirable particulate matter less than 2.5 microns in diameter [$PM_{2.5}$]), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). Under the federal CAA, attainment and maintenance of NAAQS are required.

The California Air Resource Board (CARB) has also adopted its own air quality standards in the state of California, known as the California Ambient Air Quality Standards (CAAQS) under the California CAA. The CAAQS are generally more stringent than the NAAQS and include air quality standards for all the criteria pollutants listed under NAAQS plus sulfates (SO_4), hydrogen sulfide (H_2S), vinyl chloride, and visibility-reducing particulate matter. Visibility-reducing particulate matter is defined by the State of California as suspended particulate matter with a complex mixture of tiny particles that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. These particles vary greatly in shape, size and chemical composition, and can be made up of many different materials such as metals, soot, soil, dust and salt. The California CAA established California's air quality goals, planning mechanisms, regulatory strategies, and standards of progress aimed at meeting and/or exceeding CAA requirements for air quality. The California CAA requires attainment of CAAQS for criteria pollutants by the earliest practicable date. A summary of federal and state ambient air quality standards is outlined in Table 3-1.

Table 3-1 - National and State Ambient Air Quality Standards

Pollutant		Averaging Time	California Standards [1] Concentration [3]	National Standards [2] Primary [3,4]	National Standards [2] Secondary
Ozone (O_3)[6]		1 Hour	0.09 ppm (180 µg/m^3)	—	Same as Primary Standard
		8 Hour	0.070 ppm (137 µg/m^3)	0.070 ppm (137 µg/m^3)	
Particulate Matter (PM_{10})[7]		24 Hour	50 µg/m^3	150 µg/m^3	Same as Primary Standard
		Annual Arithmetic Mean	20 µg/m^3	—	
Fine Particulate Matter ($PM_{2.5}$)[7]		24 Hour	—	35 µg/m^3	Same as Primary Standard
		Annual Arithmetic Mean	12 µg/m^3	12.0 µg/m^3	15 µg/m^3
Carbon Monoxide (CO)		1 Hour	20 ppm (23 mg/ m^3)	35 ppm (40 mg/m^3)	—
		8 Hour	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	—
Nitrogen Dioxide (NO_2)[8]		1 Hour	0.18 ppm (339 µg/m^3)	100 ppb (188 µg/m^3)	—
		Annual Arithmetic Mean	0.030 ppm (57 µg/m^3)	0.053 ppm (100 µg/m^3)	Same as Primary Standard
Sulfur Dioxide (SO_2)[9]		1 Hour	0.25 ppm (655 µg/m^3)	75 ppb (196 µg/m^3)	—
		3 Hour	—	—	0.5 ppm (1300 µg/m^3)
		24 Hour	0.04 ppm (105 µg/m^3)	0.14 ppm (for certain areas)[8]	—
		Annual Arithmetic Mean	—	0.030 ppm (for certain areas)[8]	—
Lead[10,11]		30 Day Average	1.5 µg/m^3	—	—
		Calendar Quarter	—	1.5 µg/m^3 (for certain areas)[10]	Same as Primary Standard
		Rolling 3-Month Average	—	0.15 µg/m^3	
Visibility Reducing Particles[12]		8 Hour	See footnote 11	No National Standards	
Sulfates		24 Hour	25 µg/m^3		
Hydrogen Sulfide		1 Hour	0.03 ppm (42 µg/m^3)		
Vinyl Chloride[10]		24 Hour	0.01 ppm (26 µg/m^3)		

Sources:

1. Table extracted from http://www.arb.ca.gov/research/aaqs/aaqs2.pdf on August 2016 with information dated May 4, 2016 (California Air Resource Board, 2016).

Notes:

1. California standards for ozone, carbon monoxide, sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM10, $PM_{2.5}$, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded.
2. National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 micrograms per cubic meter ($\mu g/m^3$) is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.
3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25 degrees Celsius (°C) and a reference pressure of 760 Torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 Torr; ppm in this table refers to parts per million (ppm) by volume, or micromoles of pollutant per mole of gas.
4. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
5. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
6. On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm.
7. On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM_{10} standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.
8. To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 parts per billion (ppb). Note that the national 1-hour standard is in units of ppb. California standards are in units of ppm. To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.
9. On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved. Note that the 1-hour national standard is in units of ppb. California standards are in units of ppm. To directly compare the 1-hour national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.
10. The CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.
11. The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 j.tg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
12. In 1989, the CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are “extinction of 0.23 per kilometer” and “extinction of 0.07 per kilometer” for the statewide and Lake Tahoe Air Basin standards, respectively.

Existing Conditions

The USEPA classifies the air quality within an Air Quality Control Region with regard to its attainment of federal primary and secondary NAAQS. Pursuant to USEPA guidelines, an area with air quality better than the NAAQS for a specific pollutant is designated as being in attainment for that pollutant. Any area not meeting the NAAQS is classified as a nonattainment area. Where there is a lack of data for the USEPA to make a determination regarding attainment or nonattainment, the area is designated as unclassified and is treated as an attainment area until proven otherwise. Similarly, the CARB makes state area designations for the state criteria pollutants.

Pollutant concentrations are assessed relative to both the federal and state ambient air quality standards. To determine attainment of the NAAQS and CAAQS, air districts monitor air quality through a network of air monitoring stations within their boundaries. Data collected at the monitoring stations is compiled and used to track air quality conditions and support attainment efforts.

According to the Eastern Kern APCD, Eastern Kern County is identified as attainment or unclassified for all federal standards except the 8-hour O_3 standard, and attainment or unclassified for all state standards except O_3 (1-hour and 8-hour) and PM_{10}. Federal and State attainment designations are identified in Table 3-2. Because the Proposed Action is a federal agency action, the federal designation is applicable for conformity determination. CAAQS are designations are included in Table 3-2 as a reference.

Table 3-2 – Federal and State Attainment Status for Eastern Kern County

Pollutant	NAAQS[1]	CAAQS
O_3	Nonattainment/Moderate	Nonattainment
$PM_{2.5}$	Unclassifiable/Attainment	Unclassified
[1]PM_{10}	Unclassifiable/Attainment	Nonattainment
CO	Unclassifiable/Attainment	Unclassified
NO_2	Attainment	Attainment
SO_2	Attainment	Attainment
Pb	Attainment	Attainment

Source: EKAPCD, 2016. Website accessed August 8, 2016: http://www.kernair.org/Documents/Reports/EKAPCD%20Attainment%20Status%2011-20-14.pdf.

Notes: 1 The Kern County portion where the Proposed Action is located is unclassified/attainment for PM_{10}. Other portions Kern County under EKAPCD jurisdiction, however, are classified as attainment and nonattainment (http://www.arb.ca.gov/desig/adm/2015/fed_pm10.pdf).

O_3 ozone
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
PM_{10} particulate matter less than 10 microns in diameter
CO Carbon monoxide
NO_2 nitrogen dioxide
SO2 sulfur dioxide
Pb lead

General Conformity Requirements

Section 176(c) of the federal CAA contains requirements that apply specifically to federal agency actions, including actions receiving federal funding. This section of the CAA requires federal agencies to ensure that their actions are consistent with the CAA and with applicable state air quality management plans. The general conformity regulation is codified in 40 CFR, Part 51, Subpart W, and Part 93, Subpart B.

Federal agencies are required to evaluate their proposed actions to ensure that they will not cause or contribute to new violations of any federal ambient air quality standards, that they will not increase the frequency or severity of any existing violations of federal ambient air quality standards, and that they will not delay the timely attainment of federal ambient air quality standards. To this end, the general conformity rule requires a formal conformity determination document for federally sponsored or funded actions in nonattainment or maintenance areas when the net increase in direct and indirect emissions of nonattainment or maintenance pollutants exceeds specified *de minimis* thresholds.

A federal action is exempt from general conformity requirements if the total emissions resulting from the action are equal to or less than the *de minimis* thresholds. Thus, the action's calculated emissions are compared to established *de minimis* emission levels based on the nonattainment status for each applicable criteria pollutant in the area of concern to determine the relevant compliance requirements. Table 3-3 defines the *de minimis* thresholds that apply to Kern County, Los Angeles County and San Bernardino County. The Kern County portion where the Proposed Action is located is unclassified/attainment for PM_{10}. Other portions Kern County under EKAPCD jurisdiction, however, are classified as attainment and nonattainment. Therefore, *de minimis* thresholds associated with Kern County in Table 3-3 are based on moderate nonattainment designation. If the calculated emissions are equal to or greater than *de minimis* levels, then the requirements of air conformity apply to the action.

Table 3-3 - De Minimis Thresholds in Federal Nonattainment Areas

Pollutant	Degree of Non-attainment	*De Minimis* Level (tons/year)	Kern County	Los Angeles County	San Bernardino County
O_3	Serious	50			
	Severe	25		X	
	Extreme	10			
	Marginal and Moderate (outside an ozone transport region)	100	X		
	Marginal and Moderate (inside an ozone transport region)	50 (VOC)			
		100 (NO_x)			
CO	All	100			
PM_{10}	Moderate	100			X
	Serious	70	X		
SO_2 or NO_2	All	100			
Pb	All	25			

Notes: O_3 ozone
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
CO Carbon monoxide
NO_2 nitrogen dioxide
SO2 sulfur dioxide
Pb lead

California Environmental Quality Act

The California Environmental Quality Act (CEQA) is a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. CEQA applies to certain activities of state and local public agencies. A public agency must comply with CEQA when it undertakes an activity defined by CEQA as a "project." A project is an activity undertaken by a public agency or a private activity that must receive some discretionary approval (meaning that the agency has the authority to deny the requested permit or approval) from a government agency that may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment.

Most activities at Edwards AFB are not subject to CEQA as they do not require any discretionary action by a state or local agency. As discussed in Section 2.7, the MBAL operates under a Solid Waste Facility Permit issued by the Kern County Public Health Services Department. This permit was the subject of analysis and approval under CEQA. While continued operation of the landfill is not subject to further CEQA review at this time, the vertical expansion of the landfill

may require additional review if Edwards AFB decides to move forward with this alternative and once final grading plans, formal capacity calculations, site life and fill sequencing plan are finalized. CEQA is discussed here for air quality because the impact significance determination for air emissions discussed in Section 4.1 compare project-related emissions to both federal and state standards in the event that additional CEQA analysis may be required at a future point in time when Edwards AFB may need to move forward with the vertical expansion alternative.

3.1.2 Greenhouse Gases

Background

Changes in global climate patterns have recently been associated with global warming, an average increase in the temperature of the atmosphere near the Earth's surface, attributed to accumulation of greenhouse gas (GHG) emissions in the atmosphere. Climate change refers to any significant change in measures of climate, such as average temperature, precipitation, or wind patterns over a period of time. Greenhouse gases trap solar heat in the atmosphere, which in turn heats the surface of the earth. Some GHGs occur naturally and are emitted to the atmosphere through natural processes, while others are created and emitted solely through human activities (e.g., combustion of fossil fuel). Common GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). GHGs are commonly quantified in the equivalent mass of CO_2, denoted as carbon dioxide equivalent (CO2e), which takes into account the global warming potential (GWP) of each individual GHG compound. The most common GHG that results from human activity is CO_2, followed by CH_4 and N_2O.

CO_2 enters the atmosphere through burning fossil fuels (coal, natural gas and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement). CO_2 is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

CH_4 is emitted during the production and transport of coal, natural gas and oil. CH_4 emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

N_2O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

HFCs, PFCs and SF_6 are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons).

The following paragraphs describe some approaches taken by federal agencies to address climate change:

Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance,* issued in October of 2009, states that federal agencies must increase energy efficiency, and measure, report and reduce their GHG emissions from direct and indirect activities.

Executive Order 13653, *Preparing the United States for the Impacts of Climate Change*, was signed in November 2013 provides direction for federal agencies to facilitate efforts for American communities to strengthen their resilience to climate change.

The USEPA is the agency responsible for writing and implementing federal regulation for the protection of the environment, including implementation of measures to address climate change. To this end, the USEPA pursues a number of efforts, including regulatory initiatives such as the GHG Reporting Program, standards for new motor vehicles, Renewable Fuel Standard Program, and landfill air pollution standards (USEPA, 2014).

The GHG Reporting Program (i.e., 40 CFR, Part 98) requires mandatory reporting of GHG emissions for certain industrial operations, most of which are large emitters of GHGs (e.g., electricity generation facilities, oil refineries, and manufacturing operations). Mandatory reporting is also required for facilities capable of emitting more than 25,000 metric tons of CO2-

equivalents (MTCO2e) per year from all combined stationary fuel combustion sources (e.g., boilers and stationary engines).

On July 1, 2014, the USEPA proposed updates to its air standards for new municipal solid waste (MSW) landfills, requiring certain landfills to capture additional landfill gas in an effort to reduce emissions of CH_4.

Existing Conditions

Based on the 2014 update of the California GHG inventory for 2000 to 2012 prepared by the CARB, California emitted 458.68 million metric tons (MMT) CO2e in 2012 (CARB, 2014b). According to CARB, the potential impacts in California due to global climate change may include loss in snow pack; sea level rise; more extreme heat days per year; more high ozone days; more large forest fires; more drought years; increased erosion of California's coastlines; sea water intrusion into the Sacramento and San Joaquin Deltas and associated levee systems; and increased pest infestation. As previously mentioned, various measures are currently in effect to reduce GHG emissions in an effort to mitigate climate change effects resulting from anthropogenic activity.

3.2 CULTURAL RESOURCES

This section provides the contextual background information for known cultural resources around the Main Base Active Landfill. Over the last 37 years, prior cultural resources studies were conducted in compliance with the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA, of 1966, as amended; see 16 USC 470f), and the California Environmental Quality Act (CEQA) to identify archaeological, historical built architectural resources, and other cultural resources on Edwards AFB and provide a baseline for the types of archaeological sites that may be identified within the project area.

In accordance with the NHPA and NEPA, the US Air Force (USAF) will perform consultation with the federally recognized Native American Tribes and tribal representatives identified by the Native American Heritage Commission (NAHC). There are four such federally-recognized Tribes with an interest in activities at Edwards AFB: Chemehuevi Indian Tribe, Colorado River

Indian Tribes, San Manuel Band of Mission Indians, and Morongo Band of Mission Indians. [Consultation information will be incorporated into this section when completed].

3.2.1 Cultural Resources Setting

This section presents a brief overview of the environmental setting and cultural history for the proposed project location. Understanding the environmental setting of a project area aids in identifying the types of resources that may be encountered during the proposed project, or that would be associated with a certain type of land use. Additional information pertaining to the environmental setting of the Antelope Valley and Mojave Desert may be found in the Edwards AFB Integrated Cultural Resources Management Plan (ICRMP) (Edwards AFB, 2012).

Prehistorically, current evidence of human occupation extends to more than 12,000 years ago. Several Numic groups lived and moved throughout the current location of Edwards AFB. Although their nomadic lifestyle did not generate elaborate architectural features, their adaptation to the harsh desert environment did leave behind an extensive record of material remains, mostly in the form of stone implements and the byproducts of their manufacture. These indigenous groups were followed in the early part of the 18th century by several Spanish military expeditions. While the Spanish expeditions traversed the Edwards AFB area, no native settlements were recorded in the area of the base during the latter part of the 18th century (Edwards AFB, 2012).

At the turn of the 19th century, the area from present day Lancaster to Buckhorn Springs attracted many interested parties in search of mining opportunities and new trails to an unexplored frontier. Hundreds of exploratory or prospect pits and mines dug by early miners are present throughout the base. Most mining activities on Edwards AFB consisted of exploratory digs for precious metals in the Kramer Hills and for bentonite clay on the lakebeds, primarily in the northeast corner of Rogers Dry Lakebed. The clay was used as a sealant/lubricant for oil exploration wells (Edwards AFB, 2012).

By 1911, many homesteads had been established in the general area of the base boundaries. Settlers raised livestock and searched the area for minerals. Traffic between what is now known

as the town of Rosamond and the area of Boron became a common sight. Mining in the area intensified as settlers staked out areas suspected of being rich in gold, borates, and copper. Successful mining for borates brought many settlers and increased travel across the dry lake areas, resulting in many additional homesteads. Large trenches were also dug in the dry lakebeds for clay, which was used in the oil industry (Edwards AFB, 2012).

By the middle of the 20th century, the area of the current base boundaries was used for crops, grazing, and transportation corridors for wagon trains heading northward across the valley. In the late 1800s, many settlers were raising livestock. Ranching prior to that time was concentrated in areas near the lakebeds where hand-dug water wells made ranching easier and more profitable for settlers. During the spring, large flocks of sheep were grazed in the region. These settlers dug many wells for their use just east of Rosamond and Rogers Dry Lakes. Although Edwards AFB has not allowed grazing for more than 50 years, portions of Edwards AFB are still recovering from past overgrazing practices. Illegal sheep grazing occasionally occurred on the northern boundary of the base (Edwards AFB, 2012).

Nearly every aircraft entering the Air Force inventory over the past four decades has been tested and developed at Edwards AFB. Other DOD agencies have historically used Edwards AFB for developmental test and evaluation of fixed- and rotary-wing aircraft. Edwards AFB has also been the site where lifting-body research flights helped NASA develop and design the space shuttle. Edwards AFB was the site of the space shuttle's approach and landing tests, and the first shuttle landing from space (Edwards AFB, 2012).

Archaeological and architectural surveys and evaluations of cultural resources at Edwards AFB have revealed historic properties eligible for listing on the National Register of Historic Places (NRHP). A summary of the current results of these investigations are noted below (Edwards AFB, 2012):

Archaeological Resources

Based on the 2012 Integrated Cultural Resource Management Plan, of the approximately 308,000 acres of land managed by Edwards AFB, 203,012 acres (66 percent) have been surveyed through fiscal year 2011, to provide the following findings:

- 4,657 sites have been identified.
- 1,218 found ineligible.
- 3,439 found eligible to the NRHP or, as yet, unevaluated.
  - 1,524 are prehistoric.
  - 1,915 are historic.

Architectural Resources

Over 3,200 buildings and facilities listed in Edwards AFB Real Property database (Automated Civil Engineering System) are tracked by the Base Historic Preservation Officer (BHPO) for historical significance. Over 800 facilities do not require historic assessment, as they are infrastructure elements. Of the potentially historical buildings and facilities, 851 have been evaluated as of fiscal year 2015, with the following results:

- 204 buildings and facilities have been determined as eligible, contributing or non-contributing elements for listing on the National Register of Historic Preservation (NRHP), with California State Historic Preservation Officer (SHPO) concurrence. These buildings and facilities have the following DoD Historic Status Codes:
  - 14 are NREI (Individually Eligible for the NRHP)
  - 146 are NREC (Contributing to a District Eligible for the NRHP)
  - 44 are NCE (Non-Contributing Element of NHL/NRL/NRE District)
- 179 have been determined DNE (Determine Not Eligible) with California SHPO concurrence.
- 448 have not received a determination (concurrence or non-concurrence) from California SHPO.
- 1,536 have not been evaluated and hold an NEV (Not Evaluated) status code.
  - The new Fence to Fence contract stipulates 50 building evaluations are to occur each contract year.

Traditional Cultural Properties and Sacred Sites

Five sacred sites have been identified at the Base by an American Indian tribe. Because there are no identified TCPs at Edwards AFB, it is highly unlikely that any previously unknown TCPs would be discovered at the MBAL. While the locations of sacred sites are confidential, they are also not likely to occur at the MBAL because of the high level of disturbance that has occurred there over a long period of time. In addition, the look of the MBAL will not change substantially

with any of the alternatives and, therefore, would not affect any potential viewsheds at Edwards AFB or in the local area (none of which have been identified). Therefore, none of these issues are discussed further in this EA.

3.2.2 Cultural Resources in the Vicinity of the Main Base Landfill

The cultural resource area of potential effect (APE) was considered to be the area up to 250 meters from the proposed landfill permit boundary. Several cultural resources were located within the APE; however, no cultural resources are located within the proposed permit area of the Main Base Active Landfill (CSC 1992). A records search and site survey was conducted for the landfill area and a report was prepared that identified seven cultural resources (four historic and three prehistoric) within 1 mile of the Main Base Active Landfill but none within the boundary of the MBAL. This survey did not include a 300 acre section north of the MBAL, described in Minimization Measure Cultural-1 (MM CUL-1) in Section 4.2 of this EA. These resources were identified as three prehistoric lithic concentrations, one historic railroad siding, one historic railroad station, one historic homestead, and historic oil exploration site (CSC 1992).

3.3 GEOLOGY AND SOILS

This section provides information on the topography, geology and potential seismic hazards and soils in the vicinity of the Main Base Active Landfill.

3.3.1 Topography

Typical basin and range topography observed in southwestern deserts is found at Edwards AFB (Edwards Air Force Base, 2012a). These features include mountain ranges and hill systems, alluvial fans, valley floors and basins. Rocky, gravelly and sandy washes are found throughout the Base. Antelope Valley is a closed topographic basin characterized by an interior drainage where infrequent storm water flow to Rogers Dry Lake, Buckhorn Dry Lake and Rosamond Dry Lake. Elevations at Edwards AFB range from 2,267 feet above mean sea level (AMSL) at Rogers Dry Lake to 3,424 feet (AMSL) at Red Buttes located on the installation's eastern boundary.

The Main Base Active Landfill site gently slopes to the southwest. Elevations range from 2,370 to 2,420 feet AMSL. Shallow, ephemeral drainage channels approach the area from the northeast, either crossing a part of the site or ending against an earth embankment to the northeast. The channels join a larger channel that parallels Landfill Road (Earth Tech, 1992).

3.3.2 Geology

Edwards AFB lies in the western portion of the Mojave Desert physiographic province which includes tertiary volcanic rocks and Quaternary alluvial sediments that overlie a basement complex consisting primarily of granitic intrusive rocks. Most of Edwards AFB is underlain by basement rock consisting primarily of quartz monzonite, an intrusive igneous rock similar to granite. Small, isolated exposures of carbonate rocks and volcanic tuff and basalt occur in the Bissel Hills found in the northwestern portion of the Base. Quaternary sediment deposits include older alluvium that is presumably of Pleistocene age, younger Holocene age, lacustrine sediments, and Holocene silt and sand deposits by wind and wave. Older alluvium consists of conglomerate, gravel, sand, silt and clay in thicknesses up to 1,000 feet. It covers much of Edwards AFB, forming portions of alluvial fans that extend from the rock outcrops on the hills down to the basins. Lacustrine sediments are sand, silt and clay that occupy both the present-day lakebeds, such as Rogers Dry Lake. Eolian sediments cover sizeable areas extending mainly from south and southwest of Rosemond Dry Lake east, past Rogers Dry Lake up the broad west slopes of the hills east of Rogers Dry Lake as well as scattered in smaller areas.

3.3.3 Seismicity

Southern California where Edwards AFB is located is seismically active. The San Andreas Fault Zone is located approximately 12 miles southwest of the southwestern corner of Edwards AFB, and the Garlock Fault Zone is approximately 12 miles to the northwest of the northwestern corner. The Garlock Fault Zone trends southwest-northwest and meets the San Andreas Fault 45 miles west of the Base. During the last 20 years, major earthquakes recorded near Edwards AFB at greater than 5.0 on the Richter Magnitude Scale (United States Geological Survey 2009) include the Landers and Big Bear earthquakes in June 1992 and the Mojave earthquake in July 1992.

Major faults mapped at Edwards AFB generally parallel, northwest-southeast trending normal faults. Alluvial deposits generally conceal the surface traces of these faults. Although there are no large active fault zones on the Base, the relative motion of the San Andreas and Garlock fault zones are responsible for the formation of a series of minor faults in the Mojave Desert including the six fault zones on the Base.

The closest reported fault to the landfill is not shown on the *Fault Activity Map of California and Adjacent Areas;* it is the inferred trace of the Bissell Hills-Mirage Valley Fault, located approximately 500 feet southwest of the Main Base Active Landfill (Tetra Tech 2014b). This inferred fault trace trends northwest, parallel to the Mojave Creek wash. While the activity rate of this portion of the Bissell Hills-Mirage Valley Fault was not documented in the data reviewed for this study, the apparently related Mirage Valley Fault is was reported by Tetra Tech (2014b) as showing evidence of displacement in late Quaternary time on *Fault Activity Map of California and Adjacent Areas.* The fault traces of the Mirage Valley Fault in the vicinity of Mirage Lake (approximately 30 miles southeast of the landfill) indicate that the most recent known fault rupture occurred during the middle to late Pleistocene in the Mirage Valley (Tetra Tech 2014b)

3.3.4 Soils

A basewide survey of soils at Edwards AFB has been completed by the Natural Resources Conservation Service (NRCS) (Edwards Air Force Base, 2012b). Most of the soils at Edwards AFB outside of the dry lakebeds are sandy loams and loamy sands. Some of the soils have a silt or clay component especially those associated with the dry lake beds. Many of the soils have been classified to a series level where only one taxonomic unit describes the soil. Much of the soils at Edwards AFB have been classified as complexes where two or more taxonomic units have been used to describe the soil. A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas.

Soils at the landfill are sandy in nature and have been classified as follows (NRCS 2016).

- Cajon loamy fine sands, 0 to 2 percent slopes;

- Helendale loamy sand, 0 to 2 percent slopes;
- Helendale fine sandy loam, 0 to 1 percent slopes; and
- Muroc-Randsburg complex, 2 to 5 percent slopes.

3.4 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

For purposes of this study, the terms “hazardous material” and “hazardous waste” are those substances defined by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Resource Conservation and Recovery Act (RCRA). A hazardous material is any material whose physical, chemical or biological characteristics, quantity, or concentration may cause or contribute to adverse effects in organisms or their offspring; pose a substantial present or future danger to the environment; or result in damage to or loss of equipment, property or personnel. Hazardous wastes are substances that have been “abandoned, recycled, or are inherently waste like,” and due to their quantity, concentration and/or characteristics, may cause increases in mortality or serious irreversible illness, or pose a substantial hazard to human health or the environment if improperly treated, stored, transported or disposed of.

3.4.1 Hazardous Materials and Hazardous Waste at the Main Base Landfill

Hazardous Materials. Existing and past land use activities are potential indicators of hazardous materials and hazardous waste storage and use. The primary reason to define potentially hazardous sites is to protect project landfill operations personnel plus members of the public accessing the landfill health and safety and to minimize public exposure to hazardous materials during operations and waste handling.

At Edwards AFB, direction for managing hazardous material acquisition, use and disposal is provided in operation-specific management plans (Edwards Air Force Base 2012b). These plans describe how personnel manage hazardous materials and subsequent waste. At Edwards AFB, the Hazardous Material Cell located at base supply, stocks, stores, issues and tracks hazardous materials. The hazardous materials are issued to satellite distribution points for use by organizations on Base. The satellite distribution points are responsible for day-to-day issuance

of hazardous materials and tracking that use. Excess hazardous materials that are not utilized by the organization that originally purchased them enter into the Hazardous Material Excess Reutilization Program (HazMER).

At the Main Base Active Landfill, waste is screened for household hazardous waste (HHW) and hazardous waste (HW) from commercial/industrial operations. Measures have been implemented to prevent the acceptance and disposal of HW at the baler operations and at the active landfill face. Waste received at the landfill is subject to a visual review by operators to ensure that potentially hazardous materials are identified and removed. A visual inspection takes place: In order to prevent the accidental disposal of hazardous waste, the landfill is operated in conjunction with the comprehensive household hazardous waste program at Edwards AFB. The program includes an educational campaign which will identify the types of waste residents should not dispose of in their household waste. Residents of Edwards AFB have access to household hazardous waste collection on designated days, providing safe disposal of hazardous materials.

Hazardous Waste. The Main Base Active Landfill is a Class III non-hazardous solid waste landfill pursuant to Article 3 (Waste Management Unit, Facility, or Disposal Site Classification and Siting) of Subchapter 2 of Title 27 CCR. A Class III landfill is permitted to receive non-liquid, non-hazardous wastes, including residential, construction and demolition, commercial, industrial wastes, and tires. However, tires are not accepted for off-base recycling by the landfill contractor, and are only generated at the landfill when illegally disposed of in waste dumpsters. Waste tires are not accepted at the landfill from any source. The sources of wastes received at the landfill are residences, commercial facilities, and contractor operations on Edwards AFB (Edwards Air Force Base, 2015a).

The Main Base Active Landfill does not accept hazardous waste. During a 1991 waste characterization study, household hazardous waste was shown to comprise less than 0.1 percent of the residential and commercial waste stream. Edwards AFB has implemented a comprehensive hazardous waste screening program to prevent the disposal of hazardous waste at the landfill. In order to prevent the accidental disposal of hazardous waste, the landfill is operated in conjunction with the comprehensive household hazardous waste program at Edwards

AFB. The program includes an educational campaign which will identify the types of waste residents and workers should not dispose of in their household and office waste (Edwards Air Force Base, 2015a). Residents of Edwards AFB have access to household hazardous waste collection, providing safe disposal of hazardous materials by the privatized housing contractor.

3.4.2 Environmental Restoration Program

The Environmental Restoration Program (ERP) identifies, investigates and remediates releases of hazardous substances associated with past Department of Defense activities. In the summer of 1989, the United States Environmental Protection Agency (USEPA) listed Edwards AFB on the National Priorities List under CERCLA. A Federal Facilities Agreement (FFA), which became effective in October 1990, was subsequently negotiated among Edwards AFB, USEPA, California Regional Water Quality Control Board-Lahontan Region (CRWQCB), and the California Department of Toxic Substances Control (DTSC). In accordance with the FFA, the USEPA and State agencies (DTSC and CRWQCB) provide oversight of the investigation and restoration activities. The USEPA and State agencies jointly oversee all CERCLA sites at Edwards AFB, while the CRWQCB oversees the petroleum sites managed under the Air Force Compliance Restoration Program (CRP). Prior to 2013, petroleum sites under the Air Force CRP at Edwards AFB were under the regulatory oversight of Kern County Environmental Health Services Department. Beginning in 2013, regulatory oversight of the petroleum-only CRP sites was transferred to the CRWQCB (Tetra Tech, 2014a).

Currently, there are 10 Operable Units (OUs) that have been identified by the Air Force at Edwards AFB:

- OU1 and OU8 – Main Base/Flightline Area and Northwest Main Base;
- OU2 – South Base;
- OU3 – Basewide Water Wells;
- OU4 and OU9 – AFRL Sites;
- OU5 and OU10 – North Base;
- OU6 – NASA Armstrong Flight Research Center; and
- OU7 – Basewide Miscellaneous Sites.

A Record of Decision (ROD) is a legal document signed by Edwards AFB, USEPA, DTSC and the CRWQCB that identifies the selected methods for long-term cleanup or management of contamination at a site or OU. Fourteen RODs have been defined to address all contaminated sites in the 10 OUs. Currently, eight RODs have been signed:

- OU3- Basewide Wells;
- OU6-NASA/Armstrong Flight Research Center;
- OU4/9-Air Force Research Laboratory (AFRL) West and AFRL East;
- OU4/9-AFRL Soil and Debris;
- OU2-South Base;
- OU7-Chemical Warfare Materiel;
- OU7 Site 3 Landfill; and
- OU2-South Base ROD Amendment for Site 29 Landfill.

The MBAL has been identified under the ERP as Site 4 and is not regulated under CERCLA. Past investigations of soils and groundwater have been conducted at the MBAL. Sampling completed in 2009 and 2013 showed that the source of nitrate in groundwater and soil nearby is natural, and that a remedied leaking water pipe in the area had probably served to mobilize nitrate from overlying formations and/or weather bedrock to produce the observed nitrate concentrations (Edwards AFB, 2015b). With only limited exceptions, however, it was not possible with isotopic techniques to differentiate measured nitrate among process, sewage/manure or natural sources, due to denitrification and the variability of initial isotopic signatures of sources (Edwards AFB, 2015b). As a result, since the detected nitrate was at concentrations exceeding the Maximum Contaminant Level (MCL) in groundwater, it was determined to be considered a Contaminant of Potential Concern (COPC) at EAFB (Edwards AFB, 2015b).

3.5 INFRASTRUCTURE

Infrastructure refers to the physical components that are used to deliver something (e.g., electricity, traffic) to the point of use. Elements of infrastructure typically include energy, water, wastewater, electricity, natural gas, liquid fuel distribution systems, communication lines (e.g., telephone, computer) and transportation systems (streets and railroads).

3.5.1 Electrical and Natural Gas

Edwards AFB uses electricity, solar power (e.g., photovoltaic panels to run traffic lights and heat water), and natural gas/propane and other petroleum-based products (gasoline, jet fuel, and diesel) as sources of energy to operate facilities, vehicles, equipment and aircraft (Edwards Air Force Base 2006).

Southern California Edison provides electricity to Edwards AFB. Edwards AFB uses this energy source to operate a variety of systems including lighting, heating and cooling, computers, and pumps for gas and water. Pacific Gas & Electric supplies natural gas to Edwards AFB. Edwards AFB uses natural gas to run boilers, furnaces, and two standby generators. Propane is used in areas where natural gas services are unavailable and is used to operate one standby generator. Edwards AFB uses solar energy for hot water and forced air heating systems; to provide light (i.e., skylights); and to operate the emergency phone system on major portions of Rosamond, Lancaster and Mercury Boulevards (Edwards Air Force Base 2006).

The MBAL is served by electrical lines, but does not have access to the use of natural gas (Edwards AFB 2015c).

3.5.2 Water Distribution System

Edwards AFB obtains potable water from two primary sources: Antelope Valley East Kern (AVEK) Water Agency and groundwater from on-base wells. There are three independent water distribution systems at Edwards AFB. One of the systems serves the Main Base, North Base, and South Base areas. The AVEK Water Agency supplies water to this first system from its water lines paralleling State Highway 58 and Rosamond Blvd, and through Pump Station 4004 south of the North Gate entrance. The second system serves the AFRL, although water in that system comes from Boron, which exceeds federal arsenic levels, so it is no longer used. Water for the AFRL now comes from Edwards AFB well east of the Lakebed. The third system was added to the Main Base system in an amendment to the existing supply that serves the Gun Club area. The Gun Club water system is a small distribution system serving a transient population (U.S. Air Force 2009; Ranney Adams, personal communication, 2016).

The existing Edwards AFB water distribution system started as two separate systems (North Base and South Base). As housing areas and Main Base facilities were constructed, the systems were interconnected into one system.

Potable water is provided to the MBAL via a water distribution line that follows Landfill Road (Edwards AFB 2015c).

3.5.3 Wastewater and Storm Water Systems

The wastewater collection and treatment system at Edwards AFB provides wastewater collection, onsite treatment, and onsite disposal or reuse of treated wastewater and sludge (which is disposed of offsite) for all Base facilities. There are two independent wastewater collection and treatment systems at Edwards AFB. The first wastewater collection and treatment system serves the Main Base, North Base and the South Base areas. The second wastewater collection and treatment system serves the AFRL (U.S. Air Force 2009).

Storm water is collected and transmitted through earthen channels and drainage structures. These structures direct surface water to either the dry lake bed or storm water retention ponds. The flightline storm water retention pond was eliminated due to bird airstrike hazard (BASH). With the exception of the AFRL area, most development has occurred in low-lying areas along the western perimeter of Rogers Dry Lake. Storm water runoff reaching these areas requires collection and removal (U.S. Air Force 2009).

The storm water drainage system consists primarily of drainage ditches with some storm sewer structures in the developed areas. These ditches and storm sewers generally flow west to east and empty into the Rogers Dry Lake, or the storm water retention ponds east of the Main Base flightline. Storm water runoff in undeveloped areas flows into the nearest dry lake.

The topography of Edwards AFB prevents the efficient use of traditional storm water drainage improvements. The level terrain prevents flows from achieving velocities sufficient to keep the channels clear. The easily eroded soil in the undeveloped, upstream areas of the base tends to cause the drainage channels to fill with silt, leading to flooding. Additionally, Rogers Dry Lake has bottom elevations only slightly lower than those of the storm water channels entering it;

therefore, flooding must be anticipated. Areas prone to flooding include Rogers Dry Lake, Rosamond Dry Lake, Mojave Creek, and portions of the Military Family Housing area as well as low-lying areas in the Main Base industrial area.

The MBAL is not served by a sewer line, but a storm water line services the area along Landfill Road (Edwards AFB 2015c).

3.5.4 Transportation System

One U.S. highway and two state highways connect Edwards AFB to the local communities and the interstate highway system. U.S. Route 395 parallels and crosses into the eastern boundary of Edwards AFB and connects to Interstate 15, 40 miles to the south in San Bernardino county, and Interstate 80, 380 miles to the north in Reno, Nevada. California State Route 58 parallels and crosses into the northern boundary and connects to Interstate 15, 50 miles east in Barstow, and Interstate 5, 77 miles west in Bakersfield. California State Route 14 (Antelope Valley Freeway) parallels the western boundary intersecting State Route 58 at Mojave at the northwestern corner of the installation and connects to Interstate 5, 53 miles to the south. The California Department of Transportation has developed plans for enhancing both U.S. Route 395 and State Route 58.

Vehicular traffic accesses the installation through three gates. West Gate is located on Rosamond Boulevard approximately 9 miles from the western boundary and handles 47 percent of all base traffic. South Gate is located on Lancaster Boulevard approximately 2 miles from the southern boundary, and handles 18 percent of all base traffic. The North Gate is located on Rosamond Boulevard at the northern boundary and handles 35 percent of all base traffic.

Edwards AFB has two primary roads, Rosamond and Lancaster Boulevards, which carry the majority of base traffic. Six secondary roads distribute traffic from the primary roads to the residential areas, flightline areas, North and South. These are Forbes Avenue, Wolfe Avenue, Yeager Boulevard, and Fitz-Gerald Boulevard. Fitz-Gerald Boulevard provides primary access to the Commissary, Army Air Force Exchange Service, and base housing. Jones Road and North Base Road are the sole access routes from a primary road (Lancaster Boulevard) to existing activity areas. Mercury Boulevard and Rich Road are the two primary roads accessing the

AFRL. All other roads are classified as tertiary, feeder, or unpaved roads serving individual areas on the installation.

Waste collection at the Base currently consists of 1 vehicle for collection, two roll-off vehicles, and 1 to 2 vehicles for recycling. Waste is collected from throughout the developed portions of the Base, with all waste brought to the MBAL, which is located on Landfill Road, northwest of the Family Housing Area. Collection at the Air Force Research Laboratory (Rocket Lab) requires the collection truck to exit the Base through the North Base exit, drive off Base and then come back on the Base to collect the trash, and return the same way to dispose of the waste at the MBAL.

3.6 NATURAL RESOURCES

This section provides information on the vegetation and wildlife communities likely to occur at and immediately surrounding the MBAL, including sensitive species and habitats.

The information provided in this section is based primarily on the Edwards AFB Integrated Natural Resources Management Plan (INRMP) (Edwards Air Force Base, 2015) and previous environmental analyses (County of Kern 2009; CSC 1992; and, Edwards Air Force Base 2015). Most of the 137 acres of the MBAL, including all of the actively worked areas, have been highly disturbed and no longer contain native vegetation.

3.6.1 Vegetation and Wildlife Communities

Edwards AFB vegetation communities are described in the INRMP. The MBAL is located in an area that originally supported Xerophytic Saltbush Scrub, although very little native vegetation remains within the fence of the MBAL. Xerophytic communities on EAFB are typically dominated by allscale (*Atriplex polycarpa*), found as remnants within the MBAL fence line, currently dominated by nonnative species such as Russian thistle (*Salsola tragus*).

Species commonly found in disturbed areas of Edwards AFB, including the MBAL, include common native species such as:

Birds: turkey vulture (*Cathartes aura*), mourning dove (*Zenaida macroura*), greater roadrunner (*Geococcyx californianus*), horned lark (*Eremophila alpestris*), and white-crowned sparrow (*Zonotrichia leucophrys*);

Reptiles: side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), and Mojave rattlesnake (*Crotalus scutulatus*); and

Mammals: black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audobonii*), and coyote (*Canis latrans*).

Nonnative species, or species native to California, but not the Mojave Desert, are also often found in disturbed areas of the Base, including the MBAL, and include house sparrow (*Passer domesticus*), and California ground squirrel (*Spermophilus beechyi*).

3.6.2 Sensitive Species and Habitats

One species protected by the federal (and California) Endangered Species Acts (ESAs) is found near the MBAL: the desert tortoise (*Gopherus agassizii*), an herbivorous reptile whose native range includes the Sonoran and Mojave deserts of southern California. The MBAL is not located within critical habitat designated for this species in 1994 (USFWS 1994, revised 2011). Desert tortoises are known to occur in low densities in the vicinity of the MBAL, but are unlikely to be found within the fence line.

The federal Migratory Bird Treaty Act (MBTA) protects nests of most bird species, including several sensitive species that have been found in the vicinity of the MBAL such as burrowing owls (*Athene cunicularia*), mountain plover (*Charadrius montanus*), and loggerhead shrike (*Lanius ludovicianus*).

No sensitive habitats such as federally protected waters or designated critical habitat are found on or near the MBAL.

3.7 NOISE

The major sources of noise at Edwards AFB are vehicle traffic on streets from staff, contractors, and vendors traveling to and from the Base, and aircraft operations, including air traffic and engine testing. Motor vehicle noise at Edwards AFB originates mainly at Lancaster Boulevard, Rosamond Boulevard, and primary and secondary streets on the Base.

The methodology for describing the statistical characteristics of community noise-level fluctuations is the percent of exceedance. For example, if the noise level during a certain time period exceeds 65 decibels on the A-weighted scale (dBA) for 25 percent of the time (e.g., 15 minutes out of 1 hour), the exceedance for 65 dBA is said to be 25 percent. Noise exceedance levels are denoted by L_{10}, L_{50}, L_{90}, and so on, where the subscript represents the percent of the time that the noise level is exceeded. Additionally, environmental noise can be characterized by average levels such as the energy equivalent continuous noise levels (L_{eq}), which can be averaged over a 24-hour period or, for specific applications, it can be averaged over a portion of the day. The daytime noise level (L_d) refers to noise between 7 a.m. and 7 p.m. The day/night equivalent A-weighted noise level (L_{dn} or DNL) incorporates a 10-decibel (dB) penalty for nighttime noise between 10 p.m. and 7 a.m. to reflect the added likelihood of annoyance during this period. DNL is the standard federal metric for determining cumulative exposure of individuals to noise. DNL is the 24-hour average A-weighted dB sound level measure of noise.

Background noise monitoring conducted at Edwards AFB in May of 1993 (GRW Engineers and Tetra Tech, 1994), showed L_{dn} noise levels as being lowest in the housing area:

- From 37 dB to 68 dB at the housing area and vicinity where the maximum value (68 dB) occurred behind the hospital and resulted mainly from a continuous noise from an air conditioning system on the roof of the hospital;
- From 57 to 65 dB on North Base locations where the maximum value (65 dB) resulted from an air conditioning system on the roof of the Hazardous Waste Laboratory;
- From 69 to 76 dB in the Main Base where primary sources were aircraft operation near the facilities where noise monitoring was conducted;
- From 61 to 72 dB at the South Base where the maximum value (72 dB) was associated with aircraft operations (i.e., landings and takeoffs) at the runway;

- Noise levels at the Philips Laboratory area ranged from 46 dB to 55 dB where the maximum value (53 dB) originated from motor vehicles traveling on a near roadway.

The Community Noise Equivalent Level (CNEL) has been adopted by the State of California as the descriptor for measuring noise levels. The state recommends 60 CNEL as an acceptable level of exterior noise for residential uses, and the Air Force instruction for Air Installation Compatible Use Zone (AICUZ) directs installations in California to show those contours on their AICUZ maps. The decibel is the commonly accepted unit used to measure sound. The CNEL represents the average sound level during a 24-hour day with the addition of a 5 dB penalty for evening noise (7:00 p.m. to 10:00 p.m.) and a 10 dB penalty for nighttime noise (10:00 p.m. to 7:00 a.m.).

An aircraft noise study conducted in February 2010 for Edwards AFB to provide detailed analysis of potential noise effects related to current and projected base operations showed a CNEL range of 60 dB to 85 dB. The noise sources included in the study were airfield flight operations, range air operations by aircraft, range land-based operations, supersonic air operations, and single event sonic booms. The study produced a noise map for Edwards AFB showing that all noise contours, CNEL 60 dB to CNEL 85dB, are contained within the Edwards AFB Base boundaries (Edwards AFB, 2013).

The MBAL is fairly isolated and is not close to any sensitive receptors. Land adjacent to the MBAL (except the Main Base Inactive Landfill and the borrow pit) is undeveloped natural desert. The nearest structure is an electrical substation approximately 1,000 feet from the landfill. The only livestock site in the area is a horse stable located within 1 mile southwest of the landfill. Military family housing (MFH) is located approximately 1.3 miles south of the landfill boundary. Schools within that neighborhood are located approximately 1.7 miles south the landfill.

3.8 SOCIOECONOMICS

This section provides an overview of existing socioeconomic conditions, including employment and income. The project study area includes those areas encompassing and surrounding Edwards

AFB: Kern County, Los Angeles County, San Bernardino County, as well as local communities. This section provides the contextual background information for known socioeconomic resources within the proposed project area, as well as costs associated with the operation of the MBAL.

Socioeconomic resources are the economic, demographic, and social assets of a community. Key elements include fiscal growth, population, labor force and employment, housing stock and demand, and school enrollment.

As Edwards AFB straddles the boundaries of Kern, Los Angeles, and San Bernardino counties, it is situated in the vicinity of a number of communities, including Boron, California City, Lancaster, Mojave, North Edwards, Palmdale, and Rosamond. The activities of all counties and communities are taken into consideration in the socioeconomic analysis of the proposed solid waste management alternatives.

3.8.1 Location

Edwards AFB is located approximately 100 miles north of Los Angeles in the Antelope Valley on the western edge of the Mojave Desert. Portions of the installation are within three California counties. The majority of the installation is in Kern County (as is the MBAL), with smaller areas being located within Los Angeles and San Bernardino Counties. The installation encompasses approximately 481 square miles (over 301,000 acres) and includes two major natural features -- Rogers and Rosamond Dry Lakes (Edwards Air Force Base, 2012b).

3.8.2 Population

Population within the three counties varies. Population estimates are summarized in Table 3-4.

Table 3-4 - Study Area Population Estimates (2010-2014)

County	2010 Population	2014 Population	Percent Change 2010-2014
Kern	839,631	874,589	4.2%
Los Angeles	9,818,664	10,167,705	3.0%
San Bernardino	2,035,215	2,112,619	3.8%
CALIFORNIA	37,253,956	38,802,500	4.2%

Source: US Census Bureau, 2015

3.8.3 Income and Unemployment

A summary of income and unemployment statistics are presented in Table 3-5.

Table 3-5 - Study Area Income and Unemployment

County	Per Capita Income 2013 ($)	Median Household Income 2013 ($)	Unemployment 2015 (%)
Kern	$20,295	$29,527	10%
Los Angeles	$27,749	$55,909	7.1%
San Bernardino	$21,332	$54,090	6.1%
CALIFORNIA	$48,552	$61,094	6.3%

Source: US Census Bureau, 2015; US Bureau of Labor Statistics 2015

3.8.4 Employment and Industry

Edwards AFB makes a substantial contribution to the economic status of the surrounding communities within the Antelope Valley. Major industries in the area include agriculture, mining, and tourism, in addition to aerospace technology (Edwards Air Force Base, 2012d).

The Antelope Valley has a labor force of approximately 157,900 persons with an unemployment rate of 14.1 percent. The labor force is employed in a variety of industries, including services, manufacturing, construction/mining, retail, government, and agriculture, according to the Greater Antelope Valley Economic Alliance 2010. As of December 10, 2010, Edwards AFB employed

approximately 11,285 military, civilian, and contractor personnel, according to the City of Lancaster, 2012 (Edwards Air Force Base, 2012d).

Edwards AFB is one of the largest employers in the Antelope Valley. In 2012, there was a daily workforce of 10,647, and an annual economic impact of $1.52 billion to the local economy. A summary of the factors considered in estimating the total economic impact of Edwards AFB is shown in the Edwards Air Force Base Economic Impact Analysis (Edwards Air Force Base, 2012b).

3.8.5 Housing

Edwards AFB provides permanent housing for military members in the form of dormitories and military family housing. Edwards AFB has over 741 housing units with an occupancy rate goal of 98 percent. Housing is also available in the surrounding communities, including Lancaster, Palmdale, California City, and Tehachapi. Military family housing (MFH) is located approximately 1.3 miles south of the landfill boundary.

Because the Proposed Action does not propose the addition or removal of housing, the analysis in this EA does not address impacts related to the availability of housing.

3.8.6 Community

Edwards AFB enjoys excellent relationships and support from the surrounding communities and local governments. Local cultural events, festivals, sports, and other leisure pursuits, plus the attractions of the nearby Los Angeles metropolitan area make Edwards AFB a great jumping-off place for a myriad of activities. Numerous state and local parks and national parks are also close by (Edwards Air Force Base, 2012b).

3.8.7 Schools

There are 12 school districts within 100 miles of Edwards AFB. The ones that service Edwards AFB, North Edwards, and Boron lie within the Muroc Unified School District, which has two Kindergarten through 6th Grade elementary schools, and two comprehensive junior/senior high

schools with a total enrollment of about 2,000 students (Edwards Air Force Base, 2012b). Schools within the MBAL area are located approximately 1.7 miles south the landfill.

3.8.8 Costs Associated with Operations of the MBAL

Solid waste management costs at Edwards AFB include, but are not limited to, administration, collection, landfill operations, recycling, and environmental fees and compliance and are performed using various contracted and on-site resources. Existing Operation and collection costs are broken out by category and are based on assumed annual disposal rates, collection frequencies, special event collection, on-call services, etc. The landfill also has associated environmental cost to comply with all applicable state, federal, and department of defense laws, regulations, and requirements. The solid waste management costs are summarized in Table 3-6.

Table 3-6 - FY2014 Solid Waste Management Costs

Collections/Operations	
Refuse Collections	$218,136
Recycle Collections	$180,000
Roll-off staging and Collections	$69,015
Recycling (Operations & CRV)	$321,012
Recycling Profit [1]	($192,607)
Landfill Operations	$558,000
Over and Above GFP Maintenance	$19,992
Greenwaste/Composting	$90,992
Collection/Disposal of Tires	$3,706
Subtotal	*$1,268,245*

Environmental [2]	
Permit & Fees	$50,000
Sampling & Analysis	$150,000
Groundwater Well Maintenance	$5,000
5-Year Constituents of Concern[3]	$25,000
5-Year Permit Review Application Package	$36,000
Subtotal	$266,000
Total	**$1,534,245**

Notes: 1 – Money generated from the sale of recyclable materials

2 – Environmental costs are for landfill operations only

3 – Costs provided by Edwards AFB staff

The largest cost associated with refuse disposal at Edwards AFB is landfill operations. The landfill operations cost provided in Table 3-6 includes all equipment, personnel, fuel, reporting, and general maintenance costs associated with operation of the base landfill. The relation between landfill disposal rate and landfill operations cost is not linear. A 50 percent decrease in disposal rate does not result in a 50 percent decrease in operations cost. To maintain regulatory compliance at a landfill, many of the operational costs are fixed or nearly fixed costs. For example, the landfill operations cost in 2013 was $558,000 based on an acceptance rate of 3,400 tons of refuse and 500 tons of C&D waste, while the landfill operations cost for FY14 was $667,068 based on an acceptance rate of 5,000 tons of refuse and 3,600 tons of C&D waste. Therefore, decreasing the waste acceptance rate by 55 percent resulted in only a 16 percent decrease in operations cost.

The second largest contract cost is collections. The landfill contractor collects refuse and recyclables from the various locations on Edwards AFB, excluding MFH, and hauls it to the landfill. The contract cost for this service is provided in Table 3-6. Collection costs for privatized military family hosing refuse and recycling, and C&D debris are included under several separate contracts and were not made available for this study.

The next largest cost associated with solid waste management at the landfill is recycling. This cost includes handling, sorting, storage, and marketing of recyclable materials. Although this is the third largest cost presented in Table 3-6, it is partially recovered through the sales of recyclable materials. According to the Edwards AFB solid waste contract manager, proceeds from sales currently reimburse approximately 60 percent of the cost of operating the recycling program, although this can fluctuate depending on commodity markets.

The next largest cost associated with solid waste management is the environmental cost. Again, the costs provided in Table 3-6 are the environmental costs associated with landfill operations; there are currently no other solid waste environmental costs. These landfill associated environmental costs are mostly fixed costs that are present when the landfill is in operation and will be present for many years following landfill closure. Permits and fees and permit review application package costs may decrease after the landfill is closed but all sampling and analysis costs will continue into the post-closure maintenance period.

The composting operation cost is the next largest cost. The elimination of green waste from MFH and the move toward more xeriscaping on base has reduced the amount of nitrogen feedstock available for use during composting. This could lead to an elimination of the composting program if a new feedstock is not identified. This cost also includes grinding wood waste for use as ADC and erosion control material. This cost would likely continue if the composting operation was discontinued.

The remaining operating costs include as-needed roll-off staging and collection and tire collection and recycling.

3.9 HYDROLOGY AND WATER QUALITY

This section provides information on hydrology and water quality at the MBAL. Edwards AFB is located in a basin that is essentially closed with respect to both surface drainage and groundwater movement. Most of the precipitation of the region falls in higher elevations and any resulting storm water flow in ephemeral intermittent streambeds evaporates or infiltrates

before it reaches lower elevations. There are no perennial streams on or near Edwards AFB (Edwards AFB 2012b).

3.9.1 Surface Water in the Vicinity of the Main Base Landfill

The Antelope Valley is a closed basin, surrounded by the San Gabriel Mountains from the south to the northwest, the Hi Vista area to the east, and higher elevation areas to the north and northeast just beyond the town of Mojave. Within the low parts of the drainage system on Edwards AFB are three playas: Buckhorn, Rogers, and Rosamond dry lakes. Since Edwards AFB is located in a very arid environment, surface water flow is ephemeral, lasting only hours to days in direct response to a rainfall event. Even during the rainy season, precipitation rates and the resultant runoff are generally very small. The compact nature of the soil provides little infiltration during rainfall events. Therefore, most rainfall runs off into normally dry channels. During intense rainfalls, localized flash flooding can occur.

In an Approved Jurisdictional Determination dated 07 June 2013, the U.S. Army Corps of Engineers (USACE) indicated that there are no navigable waters of the U.S. and no waters of the U.S. within Clean Water Act jurisdiction within the Antelope Valley watershed with the exception of Lake Palmdale and the Palmdale Ditch and all water tributaries to Lake Palmdale. Edwards AFB is located within the Antelope Valley watershed. The Approved Jurisdictional Determination identified that the Antelope Valley Watershed is a closed basin situated within the western Mojave Desert, with a system of Rosamond, Buckhorn, and Rogers dry lakes as the central watershed terminus. The USACE concluded that since Rosamond, Buckhorn and Rogers Lakes are intrastate isolated waters without a surface water connection to commerce, all tributaries to Rosamond, Buckhorn and Rogers Lakes as part of the overall watershed system are also isolated and additionally have no nexus to commerce (United States Army Corps of Engineers 2013). Thus, the Antelope Valley Watershed, excluding Lake Palmdale and tributaries to Lake Palmdale, is an isolated watershed system that has no surface water connection to commerce.

Waters on Edwards AFB are primarily Riverine systems with intermittent, ephemeral surface water flow as a result of storm events. Some wetland/riparian systems are found at the golf

course, Piute Ponds and Branch Memorial Park. These systems may be subject to regulatory oversight by the State of California for proposed actions that may affect them.

The landfill is located on the side of one of a series of hills that slope gently south towards an ephemeral stream known as Mojave Creek. Drainage channels are located outside the fence lines around the site. The landfill itself has a slight divide, which runs northeast-southwest at about the existing northwestern fence line. Any runoff would move toward the drainage channels.

Flooding hazards have been determined at Edwards AFB and the category of flood hazards is defined as follows (EAFB, 2012):

- 100-Year Flood Plain where there is a 1 percent chance of a flood occurring in any given year;
- Inundated areas outside of the 100-Year Flood Plain and areas of 100-Year sheet flow with depths less than one foot; and
- Areas of possible inundation but with undetermined flood risk.

Flood hazards studies have been conducted at Edwards AFB for the most critical flood prone areas associated with Rogers Dry Lake and Rosamond Dry Lake. Mojave Creek is an ephemeral stream that originates from the Bissel Hills area found in the northeastern portion of the Base (Dinehart and Harmon, 1998). Flooding hazards from Mojave Creek have the potential for impacting areas near Main Base. Construction activities subsequent to the Mojave Creek floodplain delineation have likely altered the flooding hazard.

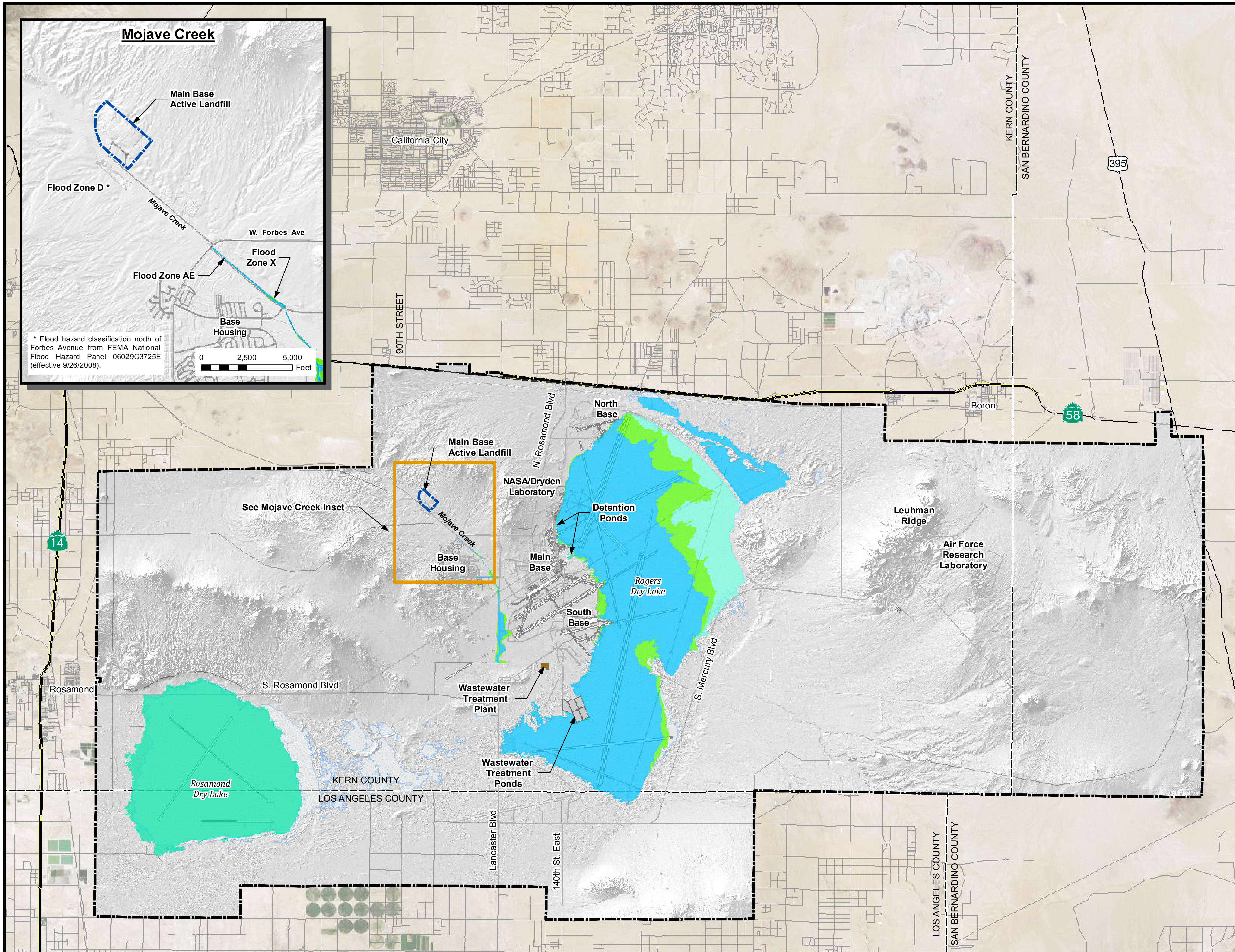
The MBAL is located northwest and outside of a mapped 100-year flood zone where base flood elevations had been determined associated with Mojave Creek (Figure 3-1).

3.9.2 Groundwater in the Vicinity of the Main Base Landfill

Within the Antelope Valley groundwater basin, Edwards AFB overlies portions of two primary subbasins, the North Muroc Basin and the Lancaster Basin, and part of one minor sub-basin, the Gloster Basin. In addition, there are three areas of shallow bedrock and low groundwater yield, known as the Rosamond-Bissel Area, the Randsburg-Castle Butte Area, and the Hi Vista Area.

The presence of discontinuous lenses of fine materials (principally clays) in the vicinity of the playa margins often cause local perched water conditions. The primary water-bearing units (older alluvium and younger alluvium) can have inter-unit properties affecting local water-bearing capacity (U.S. Air Force 1997).

Edwards AFB obtains potable water from the Antelope Valley East Kern (AVEK) Water Agency and groundwater for dust control from on-base wells. As identified in Section 3.5, Edwards AFB has three independent water distribution systems for water purveyed from AVEK. Potable water is provided to the MBAL from a distribution line that follows Landfill Road (Edwards AFB 2015c). Groundwater used at the landfill for dust control is piped to a fire hydrant at the MBAL from the nearest active base water supply well that is located 8 miles from the landfill (Edwards AFB 2009). Other than use as dust control, there are no other beneficial uses for groundwater at the MBAL, such as for domestic water supply, industrial process supply, agricultural water supply or freshwater replenishment to surface water.



0 2 4 Miles

FEMA Zone AE
Base flood elevations determined

FEMA Zone AO
Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding velocities are determined

FEMA Zone X
Area determined to be outside to 0.2% annual chance floodplain.

FEMA Zone D
Area in which flood hazards are undetermined, but possible.

Landfill Boundary

EAFB Installation Boundary

Note:
The delineated FEMA flood zones in this map are based on location specific studies of Rogers Dry Lake, Rosamond Dry Lake, Rich Dry Lake, Air Force Research Laboratory (AFRL), and the Mojave Creek watershed south of Forbes Avenue. The lack of FEMA flood zone delineation anywhere else on base does not imply that a FEMA flood zone does not exist, but rather that the area has not been subject to a FEMA flood zone analysis.

EDWARDS AIR FORCE BASE

Figure 3-1

Floodplains at the Main Base Active Landfill

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4.0 ENVIRONMENTAL CONSEQUENCES

This chapter presents the potential environmental consequences that could result from implementation of the various solid waste management alternatives. Possible changes to the natural and human environment that could result from the project alternatives were evaluated relative to existing environmental conditions described within Chapter 3.0. Mitigation measures are presented that would mitigate potentially significant adverse impacts to a level that is not significant. This chapter also provides a discussion of cumulative impacts, unavoidable adverse effects, short-term uses versus long-term productivity of the environment, and the irreversible and irretrievable commitment of resources.

4.1 AIR QUALITY AND GREENHOUSE GASES

The air and GHG emissions resulting from the Proposed Action would be short-term construction emissions, which are temporary emissions generated during the construction of a project. Short-term emissions are typically generated by on-road (e.g., employee vehicles and vendor/delivery trucks) and off-roach vehicles or equipment (e.g., backhoes, dozers, portable generators, and cranes). Short-term emissions end once the construction phase is complete.

Long-term or operational emissions are emissions resulting from activities associated with the operation of a constructed project and include emissions generated from employee and vehicle trips, equipment (e.g., boilers, water heaters, and generators).

4.1.1 Methodology and Significance Criteria

The short-term construction emissions in this EA were calculated using California Emissions Estimator Model (CalEEMod), which provides a platform for calculating emissions from a land use project. CalEEMod is designed to calculate both daily and annual emissions of criteria pollutants and GHGs. It also features built-in default values that can be used to calculate construction emissions. Default values are based on construction surveys conducted by the South Coast Air Quality Management District in order to develop default equipment usage and construction phase lengths.

Operational emissions would be generated from vehicle trips associated with the disposal of solid waste off-site. Emissions resulting from hauling solid waste off-site were calculated using emission factors from Table 2 of the *Air Emissions Guide for Air Force Mobile Sources* (Air Force Civil Engineer Center, 2014) and total vehicle miles traveled. Emission factors provide amount of pollutants emitted per vehicle mile traveled. Therefore, the product of emission factors and total vehicle miles traveled annually provides total amount of pollutant emitted annually.

Emissions would be considered significant if they would:

- Violate any ambient air quality standard or contribute substantially to an existing or projected air quality violation
- Exceed local or federal significance thresholds for criteria pollutants
- Exceed *de minimis* thresholds to determine whether or not a conformity analysis is required
- Expose sensitive receptors, such as schools, hospitals or residential areas to substantial pollutant concentrations

Since there are no sensitive receptors within a mile of the MBAL, no impacts to sensitive receptors would occur with any of the alternatives and, therefore, this issue is not discussed further.

4.1.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

Of all alternatives being considered, Alternative 1 would require the largest level of construction effort and, therefore, would result in construction emissions larger than the other alternatives. Construction emissions would result primarily from site preparation (i.e., clear and grub), soil importation and installation of a prescriptive or alternative cover, and construction of perimeter road and storm drain system. A prescriptive cover would require the most construction effort resulting in more emissions as compared to emissions that would be generated from installation of an alternative cover. Calculating the larger of the two emissions scenarios (i.e., prescriptive as opposed to alternative cover) allows for the selecting of either of the two options (i.e., prescriptive or alternative cover). The prescriptive cover would require approximately 270,000

cubic yards of imported material, which would be hauled to the Proposed Action site where it would be placed to form the selected engineered prescriptive cover over an area of 65.5 acres.

Operational emissions were calculated based on the following estimates:

- Solid waste would be hauled to an off-site landfill located approximately 22 miles from the MBAL (44-mile round trip)
- Two trips would take place each of 260 days per calendar year for a total of 520 trips per calendar year.
- The amount of waste being disposed of offsite is assumed to be the same as currently generated at Edwards AFB.

Calculated construction and operational emissions are compared against *de minimis* thresholds to determine whether or not conformity requirements are applicable and against local thresholds of significance, as a redundant measure, to determine whether or not each alternative may have any significant effect on the local environment. General conformity requirements are discussed in Section 3.1.1. Table 4-1 provides a summary of calculated emissions from Alternative 1, thresholds of significance published by the EKAPCD, *de minimis* thresholds for conformity analysis, and significance status. Detailed emission calculations are included in Appendix B. Emissions calculations are based on use of Tier 3 engines in off-road vehicles or equipment and demolition of all existing permanent buildings. Overall construction emissions would be less than those presented in Table 4-1 if none of the building were to be demolished.

Table 4-1 - Alternative 1: Landfill Closure and Off-Site Disposal Air Emissions of Criteria Pollutants and GHGs and Significance Thresholds

Project Phase and Thresholds	CO	VOC	NOx	SO_2	PM_{10}	$PM_{2.5}$	H_2S	Lead	[1]CO_2e
Construction Emissions in tpy (lb/day)	3.48 (80.1)	0.18 (4.9)	1.91 (53.9)	0.01 (0.2)	0.89 (22.4)	0.24 (6.3)	0 (0)	0 (0)	565 (15,839)
Operational Emissions tpy (lb/day)	0.01 (0.1)	0.01 (0.1)	0.03 (0.2)	0.00 (0.0)	0.00 (0.0)	0.0 (0.0)	0 (0)	0 (0)	31 (241)
[a,b]EKAPCD Significance Threshold in tpy (lb/day)	None	25 (137)	25 (137)	None	15 (82)	None	None	None	25,000 (136,986)
De minimis Thresholds (tpy)	N/A	100	100	N/A	70	N/A	N/A	N/A	N/A
Significant?	No	No	No	No	No	No	No	No	No

Source: a Source for criteria pollutants: County of Kern 2006
b Source for CO2e: EKAPCD 2012

Notes:

CO	carbon monoxide
CO2e	carbon dioxide equivalent
EKAPCD	Eastern Kern Air Pollution Control District
GHG	greenhouse gas
H_2S	hydrogen sulfide
lb/day	pounds per day
N/A	not applicable
NO_x	nitrogen oxides (nitrogen oxide and nitrogen dioxide)
PM2.5	particulate matter less than 2.5 microns in diameter
PM10	particulate matter less than 10 microns in diameter
SO_x	sulfur dioxide
tpy	tons per year
VOC	volatile organic compound

Under Alternative 1 either a prescriptive or an alternative cover would be installed to support the closure of the Edwards AFB landfill, and solid waste would be disposed off-site. While an alternative cover is preferred, air emissions were calculated for installation of a prescriptive cover to account for the maximum amount of emissions that could be generated under Alternative 1. A summary of the emissions is presented in Table 4-1. Emissions resulting from Alternative 1 would be well below *de minimis* and EKAPCD significance thresholds and would neither trigger general conformity requirements nor be expected to have a significant impact on

the environment. Since there would be no significant impacts on the environment from this alternative, no mitigation measures would be required.

However, the following minimization measures are provided to minimize fugitive dust emissions and to ensure compliance with CARB off-road regulations.

MM AQ-1: The following dust control measures are required to be implemented during land preparation, excavation and/or demolition:

- All soil excavated or graded should be sufficiently watered to prevent excessive dust. Watering should occur as needed with complete coverage of disturbed soil areas. Watering should be a minimum of twice daily on unpaved/untreated roads and on disturbed soil areas with active operations.
- All clearing, grading, earth moving and excavation activities should cease during periods of winds greater than 20 miles per hour (mph) (averaged over one hour), if disturbed material is easily windblown, or when dust plumes of 20% or greater opacity impact public roads, occupied structures, or neighboring property.
- All fine material transported off site should be either sufficiently watered or securely covered to prevent excessive dust.
- All haul trucks should be required to exit the site via an access point where a gravel pad or grizzly has been installed.
- Stockpiles of soil or other fine loose material shall be stabilized by watering or other appropriate method to prevent wind-blown fugitive dust.
- Once initial leveling has ceased, all inactive soil areas within the construction site should either be seeded and watered until plant growth is evident, treated with a dust palliative, or watered twice daily until soil has sufficiently crusted to prevent fugitive dust emission.
- On-site vehicle speed should be limited to 15 mph.
- All areas with vehicle traffic should be paved, treated with dust palliatives or watered a minimum of twice daily.
- Streets adjacent to the project site should be kept clean and accumulated silt removed.

MM AQ-2: The following measures should be implemented to control construction vehicle tailpipe emissions:

- Properly maintain and tune all internal combustion engine powered equipment;
- Require employees and subcontractors to comply with the CARB idling restrictions for compression ignition engines; and
- Use California ultra-low sulfur (CARB) diesel fuel.

4.1.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

From an emissions standpoint, Alternative 2 would be very similar to Alternative 1. Construction emissions would not increase from those calculated in Alternative 1, and operational emissions would remain virtually the same as well. Consequently, emissions resulting from Alternative 2 would be well below *de minimis* and significance thresholds and would neither trigger general conformity requirements nor be expected to have a significant impact on the environment. Since there would be no significant impacts on the environment from this alternative, no mitigation measures would be required. Implementation of **MM AQ-1** and **MM AQ-2** would ensure that fugitive dust emissions would be minimized and compliance with CARB off-road regulations are met.

4.1.4 Alternative 3 – Fewer Operating Days

Under Alternative 3, no construction or closure activities would be conducted and solid waste would continue to be processed at the MBAL. Therefore, no construction or additional operation emissions would be generated. With a reduced schedule from five to three days per week, operational emissions would be expected to decrease slightly, benefitting the environment.

4.1.5 Alternative 4 – Vertical Expansion of the Landfill

Under Alternative 4, no construction or closure activities would be conducted and solid waste would continue to be processed at the MBAL until the regulated vertical limit is reached. Under this scenario, no construction or additional operation emissions would be generated and no adverse impacts to the environment would result.

However, if the vertical expansion were to accommodate additional waste, such as currently diverted C&D waste and any other solid waste that required disposal at the MBAL in an amount equal to what is currently being disposed of (i.e., an additional 4,352 tons per year), resulting emissions would be primarily in the form of GHG from decaying solid waste. Other emissions would result from additional equipment requires to support the spreading and covering of the

solid waste. Emissions estimates associated with these activities are calculated using CalEEMod (included in Appendix B) and summarized in **Error! Reference source not found.**.

Resulting emissions would be less than thresholds presented in **Error! Reference source not found.**. Implementation of **MM AQ-1** and **MM AQ-2**, as described for Alternative 1, would ensure that significant air quality and greenhouse gas impacts would not occur.

Table 4-2 - Alternative 4: Vertical Expansion
Air Emissions of Criteria Pollutants and GHGs and Significance Thresholds

Project Phase and Thresholds	CO	VOC	NOx	SO_2	PM_{10}	$PM_{2.5}$	H_2S	Lead	[1]CO_2e
Landfill Equipment Support Emissions in tpy (lb/day)	0.70 (5.39)	0.09 (0.66)	0.88 (6.77)	0.00 (0.01)	0.04 (0.31)	0.04 (0.28)	0.00 (0.00)	0.00 (0.00)	86.90 (643.01)
Solid Waste Emissions tpy	0	0	0	0	0	0	0	0	2,182.58
[a,b]EKAPCD Significance Threshold in tpy (lb/day)	None	25 (137)	25 (137)	None	15 (82)	None	None	None	25,000 (136,986)
De minimis Thresholds (tpy)	N/A	100	100	N/A	70	N/A	N/A	N/A	N/A
Significant?	No	No	No	No	No	No	No	No	No

Source: a Source for criteria pollutants: County of Kern 2006
b Source for CO2e: EKAPCD 2012

Notes:

CO	carbon monoxide
CO2e	carbon dioxide equivalent
EKAPCD	Eastern Kern Air Pollution Control District
GHG	greenhouse gas
H_2S	hydrogen sulfide
lb/day	pounds per day
N/A	not applicable
NO_x	nitrogen oxides (nitrogen oxide and nitrogen dioxide)
PM2.5	particulate matter less than 2.5 microns in diameter
PM10	particulate matter less than 10 microns in diameter
SO_x	sulfur dioxide
tpy	tons per year
VOC	volatile organic compound

If Edwards AFB moves forward with vertical expansion of the MBAL as the selected alternative, additional more detailed environmental review (including CEQA review) may be required once final grading plans, formal capacity calculations, site life and fill sequencing plan are finalized.

4.1.6 No Action Alternative

Under the No Action Alternative, the no construction would occur and solid waste would continue to be processed at the MBAL with no change in operations. Therefore, no construction or additional operation emissions would be generated and no adverse impacts to the environment would result.

4.2 CULTURAL RESOURCES

4.2.1 Methodology and Significance Criteria

Impacts on cultural resources could result from ground-disturbing activities on any remaining native soils and/or result in damage, destruction, or alteration of historic structures. There are no historic resources at the MBAL so this issue is not discussed further. Ground disturbing activities could also damage or destroy buried cultural resources. Edwards AFB has compiled cultural resources information for the Base and identified areas where cultural resources are likely (or not likely) to occur. The MBAL is in the area where cultural resources are not likely to occur. Therefore, it is unlikely that cultural resources would be discovered with any of the alternatives. However, there is always the potential to uncover previously unknown cultural resources that will be subject to Section 106 of the National Historic Preservation Act. This typically includes the evaluation of the resource to the National Register of Historic Places, consultation with the State Historic Preservation Officer, Native American tribes, and the public. Depending on the significance of the resource and its eligibility for the National Register additional mitigation and consultation may be required.

4.2.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

With implementation of Alternative 1, the waste footprint as well as the supporting landfill activities area would not expand beyond current boundaries. The project site is enclosed by a

fence and the entire area is disturbed by existing landfill activities. After closure, the landfill would require regular inspection, maintenance, and monitoring activities. Because, the landfill area has already been extensively disturbed by ongoing landfill activities, and no new areas would be disturbed, it is unlikely that there would be any impacts to cultural resources with this alternative. There is a small potential for inadvertent discoveries during final grading of the site. However, with incorporation of minimization measure (MM) CUL-1, no impacts to cultural resources are anticipated.

MM CUL-1: Although the areas to the west, south, and east surrounding the MBAL have been previously surveyed for archaeological resources, those surveys are now over 10 years old and areas that may be affected by closure of the landfill will require re-survey. The area to the north of the MBAL has never been surveyed for archaeological sites. Therefore, up to approximately 300 acres of archaeological survey will need to be conducted on the west, north, and east sides of the MBAL, including areas that may be affected by construction of drainage features associated with closure activities. If avoidance of any newly recorded archaeological sites is not feasible then those sites will be subject to evaluation to determine their eligibility to the National Register and subsequent treatment in accordance with Section 106 of the National Historic Preservation Act. In the unlikely event that subsurface archaeological resources are discovered, work will cease immediately in the area and the Base Historic Preservation Officer (BHPO) will be contacted. A records search for any landscapes or traditional cultural properties will also be conducted by contacting the Native American Heritage Commission as well as the four federally-recognized tribes affiliated with Edwards AFB.

4.2.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

Closure of the MBAL would be as described in Chapter 2, but instead of hauling all waste directly to off-base landfills, the waste would be brought to the MBAL site for sorting and consolidation before transfer and final disposal off base. Potential impacts would be the same as for Alternative 1. With incorporation of MM CUL-1, no impacts to cultural resources are anticipated.

4.2.4 Alternative 3 – Fewer Operating Days

With Alternative 3, the only change in the operation of the MBAL would be that the landfill would operate fewer days per week. All other aspects of operation at the landfill would remain as under current conditions. This would include compliance with existing cultural mitigation measures identified in the *Mitigated Negative Declaration for the Edwards Air Force Base Solid Waste Facility Permit* (County of Kern 2009). Therefore, no additional mitigation for cultural resources would be warranted.

4.2.5 Alternative 4 – Vertical Expansion of the Landfill

With implementation of Alternative 4, the waste footprint as well as the supporting landfill activities area would not expand beyond current boundaries. Expansion of landfill capacity would occur instead vertically. There is a small potential for inadvertent discoveries during the lifetime of work at the landfill. However, with incorporation of MM CUL-1, no impacts to cultural resources are anticipated.

4.2.6 No Action Alternative

There would be no changes in current activities at the landfill with the No Action Alternative. The landfill would continue to operate under current conditions, including compliance with existing cultural mitigation measures identified in the *Mitigated Negative Declaration for the Edwards Air Force Base Solid Waste Facility Permit* (County of Kern 2009). Therefore, no additional mitigation for cultural resources would be warranted.

4.3 GEOLOGY AND SOILS

This section describes the geologic hazards and soil resources impacts that would occur with the implementation of any of the alternatives for landfill closure or alternate operational scenario.

4.3.1 Methodology and Significance Criteria

The potential impacts related to geologic and seismic hazards were evaluated by assessing if there would be life/safety concerns or impacts resulting from implementation of any of the alternatives.

The geology and soils resources found within each alternative under analysis includes geological features and soils. Other aspects of these resources include earthquakes, subsidence, unstable slopes and other hazards that limit siting and construction any of the proposed alternatives.

The following criteria were used in evaluating the significance of impacts on the geology and soil resources found at the MBAL:

- The degree to which unique or scenic landforms and topographic features would be damaged, destroyed, or rendered inaccessible by construction;
- The degree to which the stability of slopes and foundation substrates may be lessened by excavation or grading;
- The potential for naturally occurring geological events including subsidence, landslides and mudflows, and rupture and ground shaking during earthquakes, to affect construction and the operation of the selected utility corridor;
- The amount of disruption of the ground surface and destruction of the soil profile through excavation and removal of rock and soil in the construction of any alternative selected; and
- The potential for erosion caused by disturbance of the ground surface during the construction of any alternative selected particularly as a result of exposing construction areas and equipment routes to increased potential for wind or storm water soil loss.

4.3.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

4.3.2.1 Geology

Closure of the MBAL would not damage or destroy existing landforms found within the landfill site, as any natural landforms have been altered over years of use of the site as a landfill. The total permitted landfill boundary is 137 acres, which includes a 60.5-acre disposal area, a Recycling Operations Center (ROC), a 4-acre composting facility/grinder operation, a baler building, weigh scales, and the landfill office. The current operations area has been contoured and any landforms present prior to construction have been incorporated into the existing permitted landfill operation area.

This alternative has the potential to be impacted by seismic shaking resulting from an earthquake. Naturally occurring geological events including subsidence, landslides and mudflows, and rupture and ground shaking during earthquakes have the potential to affect the closed landfill.

No significant impacts related to geology or seismicity would occur and, therefore, no mitigation measures are required.

4.3.2.2 Soils

Closure of the MBAL could be accomplished by using either a prescriptive cover or an alternative cover design, both of which would comply with State requirements. For the evapotranspiration (ET) alternative cover (the proposed cover option), soils needed for the base of the cover would be excavated from either the landfill site or a borrow pit located immediately south of the landfill. The 1×10^{-4} cm/sec soil and vegetative top soil can be found within five miles of the MBAL. The use of borrow from the existing on-site sources has the potential for increasing wind and water erosion, although borrow site activities are subject to standard erosion control measures. Soil erosion of the landfill cover could also occur but the soil loss potential from surface water and wind erosion of the cover was evaluated using the U.S. Department of Agriculture (USDA) Universal Soil Loss Equation (USLE) and Wind Erosion Equation (WEE), respectively. Average soil cover loss due to the combined effects of surface water and wind

erosion over the entire site for the 30-year post-closure maintenance period is estimated to be less than 5 inches. This is conservatively estimated using a low stand of vegetation and soil type of high erodibility (Tetra Tech, 2014b [PCPCMP]).

The following minimization measure would reduce the potential for wind and water erosion that could occur during landfill closure activities**.**

MM GEO-1: Controls such as the use of water to reduce dust and stormwater control devices such as the installation of a drainage interception along the northeastern side of the balefill and the existing landfill is proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road. The system, designed to handle a 100-year, 24-hour storm, would collect off-site run-on from the upland drainage by use of interception channels that will divert the flow around the site (Edwards AFB 2015a).

This would reduce impacts to a less than significant level. Once the MBAL is closed, post closure maintenance activities would ensure no loss of soils that are part of the ET cover from wind or stormwater run-off.

4.3.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

With Alternative 2, closure of the MBAL would be the same as for Alternative 1, but instead of hauling all waste directly to off-base landfills, the waste would be brought to the MBAL site for sorting and consolidation before transfer and final disposal off base. Use of the MBAL site as a temporary transfer station would not result in new disturbance areas or a significant change in the activities conducted at the site.

As with Alternative 1, no significant impacts related to geology or seismicity would occur and, therefore, no mitigation measures are required.

Implementation of **MM GEO-1**, as described for Alternative 1, would ensure that impacts related to wind and water erosion would not occur.

4.3.4 Alternative 3 – Fewer Operating Days

Another alternative to address the decreasing waste generation rate at Edwards AFB would be to reduce operating costs by reducing operating days to three times per week. This would not change operating activities at the MBAL and, therefore, would not result in any new impacts related to geology, seismicity or soils and therefore, no mitigation measures would be required.

4.3.5 Alternative 4 – Vertical Expansion of the Landfill

The MBAL currently has an estimated life expectancy of 62.1 years and closure date of May 2076; therefore, an expansion is not critical at this time. However, if the capacity of the landfill could be expanded with minimal cost, the additional airspace may have significant value in the future. Lateral expansion has been determined to be cost prohibitive, but vertical expansion could be accomplished fairly easily and would extend the life expectancy of the landfill. Based on the historically low FY 2014 disposal rate, a 10-foot vertical expansion would provide approximately 885,000 CY of additional airspace and 70 years of additional site life.

4.3.5.1 Geology

Under this alternative, the MBAL would continue to operate past its current closure date of May 2076. Continued use of the MBAL with a vertical expansion would not damage or destroy existing landforms found within the landfill site. The current operations area has been contoured and any landforms present prior to construction have been incorporated into the existing permitted landfill operation area. This alternative also has the potential to be impacted by geology that may be unstable during a seismic event. Naturally occurring geological events including subsidence, landslides and mudflows, and rupture and ground shaking during earthquakes have the potential to affect the vertically expanded landfill.

4.3.5.2 Soils

With a vertical expansion of the MBAL, the need for daily cover borrow soils would be required, and there would be a need to reduce the potential for erosion of soils from wind or stormwater runoff.

Implementation of **MM GEO-1**, as described for Alternative 1, would ensure that impacts related to wind and water erosion would not occur.

4.3.6 No Action Alternative

Under the No-Action Alternative, the MBAL would continue its current operation with no changes. As a result, there would be no new impacts related to geology, seismicity or soils and therefore, no mitigation measures would be required.

4.4 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

4.4.1 Methodology and Significance Criteria

Under NEPA, the thresholds applicable to the analysis of potential impacts from hazardous materials and waste on public health and safety include reportable quantities of hazardous materials under CERCLA and quantitative exposure thresholds under the Federal Occupational Safety and Health Act (OSHA) and /or California Federal Occupational Safety and Health Act (CalOSHA). To evaluate impacts from existing hazardous waste within the proposed alternatives, a review was conducted of previously completed investigations associated with relevant OUs. The proposed alternatives were reviewed for their proposed actions related to worker health and safety, hazardous materials management, and spill prevention.

Edwards AFB has been engaged in a wide variety of operations that involve the use, storage and disposal of hazardous materials and hazardous waste. Although legally acceptable at the time, procedures followed prior to the mid-1970s for managing and disposal of wastes often resulted in contamination of the environment. The resulting ERP program at Edwards AFB has been undertaken according to standards set forth in state and federal regulations including as follows:

- CERCLA that established standards for containing and removing releases of hazardous substances and identifying and cleaning up contaminated sites;
- RCRA that regulates hazardous waste site recovery. RCRA also identifies hazardous wastes as ignitable, corrosive or reactive;
- Superfund Amendments and Reauthorization Act (SARA) which extends the requirements of CERCLA and modifies remediation goals and selection process;

- Toxic Substance Control Act (TOSCA) that designates certain chemicals as "imminently hazardous";
- Clean Air Act which identifies toxic and hazardous pollutants and substances;
- Clean Water Act, Safe Water Act, and Applicable or Relevant and Appropriate Requirements that identify safe levels of contaminants for water use or reuse;
- California Code of Regulations that establishes standards for the management of hazardous waste;
- Federal OSHA which develops and establishes occupational safety and health standards; and
- California Code of Regulations (CCR) that identifies California occupational safety and health regulations.

Federal OSHA/CalOSHA regulations would apply for health and safety standards of workers used during construction of any alternative selected.

4.4.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

For this alternative, the MBAL would be closed in accordance with current State of California requirements, including closure and post-closure maintenance requirements as promulgated by the CalRecycle and the SWRCB. Following closure, all waste from Edwards AFB would be transported to off-base landfills for disposal and the closed landfill would be subject to regular inspection, maintenance and monitoring activities.

Implementation of this alternative would not mobilize existing contaminants associated with MBAL Site 4 in groundwater, or expose workers to contaminated soils or groundwater at levels in excess of those permitted by federal and state law. Hazardous materials necessary for project implementation that require temporary storage at the construction area would comply with relevant Edwards AFB requirements.

The following minimization measure would further reduce potential hazards to workers from hazardous materials or hazardous waste during landfill closure activities to a level that is not significant**.**

MM HAZ-1: Prior to construction activities associated with the landfill closure, a health and safety plan in compliance with 29 CFR 1910.120 will be prepared and approved by Edwards

AFB. The site-specific health and safety plan will address all site-specific safety and environmental hazards that have the potential to be encountered during construction of the alternative, including physical hazards, biological hazards, and general safety hazards. Any training required by construction personnel will be identified.

4.4.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

With Alternative 2, closure of the MBAL would be the same as for Alternative 1, but instead of hauling all waste directly to off-base landfills, the waste would be brought to the MBAL site for sorting and consolidation before transfer and final disposal off base. Use of the MBAL site as a temporary transfer station would not result in new disturbance areas or a significant change in the activities conducted at the site.

As with Alternative 1, no significant impacts related to hazardous materials or hazardous waste would occur and, therefore, no mitigation measures are required.

Implementation of **MM HAZ-1**, as described for Alternative 1, would ensure that significant impacts would not occur.

4.4.4 Alternative 3 – Fewer Operating Days

Another alternative to address the decreasing waste generation rate at Edwards AFB would be to reduce operating costs by reducing operating days to three times per week. This would not change operating activities at the MBAL and, therefore, would not result in any new impacts related to hazardous materials or hazardous waste and, therefore, no mitigation measures would be required.

4.4.5 Alternative 4 – Vertical Expansion of the Landfill

The MBAL currently has an estimated life expectancy of 62.1 years and closure date of May 2076; therefore, an expansion is not critical at this time. However, if the capacity of the landfill could be expanded with minimal cost, the additional airspace may have significant value in the future. Lateral expansion has been determined to be cost prohibitive, but vertical expansion

could be accomplished fairly easily and would extend the life expectancy of the landfill. Based on the FY 2014 disposal rate, a 10 foot vertical expansion would provide approximately 885,000 CY of additional airspace and 70 years of site life.

Implementation of this alternative would not mobilize existing contaminants associated with MBAL Site 4 in groundwater, or expose workers to contaminated soils or groundwater at levels in excess of those permitted by federal and state law. The landfill would be vertically expanded as per regulatory standards and requirements. Hazardous materials necessary for project implementation that require temporary storage at the construction area would comply with relevant Edwards AFB' requirements. Implementation of **MM HAZ-1** as described under Alternative 1 would reduce potential hazards to workers from hazardous materials or hazardous waste during landfill closure activities**.**

4.4.6 No Action Alternative

Under the No-Action Alternative, the MBAL would continue its current operation with no changes. As a result, there would be no new impacts related to hazardous materials or hazardous waste and, therefore, no mitigation measures would be required.

4.5 INFRASTRUCTURE

4.5.1 Methodology and Significance Criteria

The following methodology and criteria were used in evaluating significance of impacts on infrastructure:

- The degree to which a utility service or transportation system would have to alter operation practices and personnel requirements;
- The degree to which the increased demands from the proposed alternative would require the development of additional capacity or new facilities;
- The degree to which the increased demands from the proposed alternative would reduce the reliability of utility service or transportation systems, or aggravate already existing adverse conditions in the affected region; and,
- The degree of damage to underground utilities that could potentially be caused by construction or operation activities, and/or the degree of environmental harm or personal injury resulting from that damage.

4.5.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

Implementation of Alternative 1 would not have any significant impacts on existing electrical, natural gas, water, wastewater treatment, storm drain systems, or communication systems currently in place at Edwards AFB. There would be a long-term, minor decrease in the need for infrastructure utilities, and there would be a long-term negligible increase in vehicular traffic off the Base due to transport of materials from the MBAL to an off-Base landfill. No significant impacts to infrastructure would occur and, therefore, no mitigation measures would be required.

4.5.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

Similarly to Alternative 1, implementation of Alternative 2 would not have any significant impacts on existing electrical, natural gas, water, wastewater treatment, storm drain systems, or communication systems currently in place at Edwards AFB. There would be a long-term, minor decrease in need of infrastructure utilities, and there would be a long-term negligible increase in vehicular traffic off the Base due to transport of materials from the MBAL to an off-Base landfill. No significant impacts to infrastructure would occur and, therefore, no mitigation measures would be required.

4.5.4 Alternative 3 – Fewer Operating Days

This alternative would not result in any changes to existing electrical, natural gas, water, wastewater treatment, storm drain systems, or communication systems currently in place at Edwards AFB. There would be a slight change in vehicular traffic because waste would only be brought to the landfill three days per week, instead of the current five days per week. No significant impacts to infrastructure would occur and, therefore, no mitigation measures would be required.

4.5.5 Alternative 4 – Vertical Expansion of the Landfill

This alternative would not result in any changes to existing electrical, natural gas, water, wastewater treatment, storm drain systems, communication, or roadway systems currently in place at Edwards AFB because even though the amount of waste processed and handled would increase, it would still be well below currently permitted amounts and would not require changes or upgrades to any infrastructure systems. No significant impacts to infrastructure would occur and, therefore, no mitigation measures would be required.

4.5.6 No Action Alternative

Under the No-Action Alternative, the MBAL would continue its current operation with no changes. As a result, there would be no impacts related to infrastructure and, therefore, no mitigation measures would be required.

4.6 NATURAL RESOURCES

4.6.1 Methodology and Significance Criteria

Impacts to natural resources can include direct and indirect impacts, as well as permanent and temporary impacts. Potential direct impacts include the disruption, trampling, or removal of rooted vegetation resulting in a reduction in the total acres of native vegetation communities, or the direct injury or death of individual plants or animals. Potential indirect impacts include the introduction of invasive species that compete with native species and can result in habitat degradation. Permanent impacts could include the permanent removal of vegetation and wildlife from the conversion of native habitat to other uses. Potential temporary impacts include those that create an impact that will revert in a short time period to a natural state, such as noise impacts related to construction that would not exist when construction is completed.

All alternatives assume continued compliance with existing biological resource mitigation measures from the *Mitigated Negative Declaration for Edwards AFB Solid Waste Facility Permit* (SWFP) (County of Kern 2009); and the terms and conditions of existing BOs (USFWS 1992; 2014) (Appendix C).

The proposed project would have a significant impact on biological resources if it meets any of the following criteria:

1. Has a substantial adverse effect on native vegetation or wildlife communities.
2. Adversely affects any species listed as endangered or threatened by the federal or state endangered species acts, or designated critical habitat for these species.
3. Result in a violation of the federal MBTA.
4. Result in a violation of the Sikes Improvement Act of 1997 (16 U.S.C. 670a-670o) and Air Force Instruction 32-7064 to provide management and sustained use of natural resources on Air Force facilities.
5. Has a substantial adverse effect on sensitive plant or wildlife species.
6. Violate any provisions of the existing Biological Opinion (BO) for the Landfill (USFWS 1992) or the Basewide Programmatic BO (USFWS 2014).

4.6.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

Under Alternative 1, no native vegetation or wildlife communities would be directly removed, nor sensitive species directly affected because the landfill area has already been disturbed by existing landfill activities and is surrounded by a fence, and all closure activities at the MBAL would take place within the already fenced area.

Construction and monitoring activities associated with the landfill closure could have direct and temporary impacts to nesting birds, including possibly burrowing owls and other sensitive bird species, considered a significant impact if they were in violation of the federal MBTA. **MM NR-1** will be implemented to avoid these impacts.

Indirect temporary impacts associated with closure activities or ongoing monitoring and maintenance activities may include locally increased noise and dust. Because the MBAL currently supports activities that create noise and ambient dust conditions exist in the Mojave Desert, the temporary increase of these factors in localized areas for the closure activities is

expected to be minimal. This impact is expected to be less than significant and requires no avoidance and minimization measures.

With the incorporation of **MM NR-1** into the project, no significant natural resources impacts are likely to occur.

MM NR-1: Pre-construction surveys will be conducted during nesting season to ensure compliance with the federal MBTA and avoid nesting impacts to burrowing owls and other bird species. These surveys will be conducted no more than 5 days in advance of initial disturbance. If the project impacts are to occur during the breeding season and owls or nesting birds are found occupying habitat within the disturbance area, disturbance of nests will not occur when active nests contain eggs or fledglings. If the project impacts are to occur outside of the breeding season and owls or other nesting birds are found occupying habitat within the disturbance area, passive relocation (via one-way doors and collapse of burrows) will occur. If no active nests are found within the disturbance area during the pre-construction surveys, the proposed disturbance activities may proceed.

4.6.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

With Alternative 2, closure activities would be the same as described for Alternative 1 and, therefore, impacts would be the same. Activities associated with the transfer station would be similar to existing landfill activities in that truckloads of waste would be brought to the landfill and processed for off-site disposal. As with Alternative 1, impacts to natural resources would be minor. With the incorporation of **MM NR-1** into the project, no significant natural resources impacts would occur.

4.6.4 Alternative 3 – Fewer Operating Days

Under Alternative 3, neither the waste footprint nor the overall landfill area would expand. The landfill would continue to operate as under current conditions albeit with fewer operating days per week. No new impacts to natural resources would occur.

4.6.5 Alternative 4 – Vertical Expansion of the Landfill

With Alternative 3, waste would continue to be disposed of at the MBAL and the landfill would be expanded vertically to accommodate additional waste, but the waste footprint would not be changed. With the incorporation of **MM NR-1** into the project, no significant natural resources impacts would occur.

4.6.6 No Action Alternative

Under the No Action Alternative, landfill activities would not change and, therefore, no natural resources would be affected. The landfill would continue to operate under current conditions including existing biological resource mitigation measures (identified above in Section 4.6.4). No additional impacts would occur and, therefore, no mitigation for natural resources would be warranted.

4.7 NOISE

4.7.1 Methodology and Significance Criteria

Noise may be generated from a point source, such as a piece of construction equipment, or from a line source, such as a road containing moving vehicles. Because noise spreads in an ever-widening pattern, the given amount of noise reaching an object, such as an eardrum, is reduced with distance from the source. For closure of the MBAL, the primary source of noise would be during construction of the landfill cover. These impacts would be temporary. Operational noise would be negligible, as it would be limited to the occasional use of equipment and vehicles for maintenance purposes. Noise impacts would be significant if they affect sensitive receptors, such as residences, schools, and hospitals. However, the MBAL is fairly isolated and is not close to any sensitive receptors.

4.7.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

Noise associated with implementation of Alternative 1 would primarily result from vehicles used during the transport of soil for constructing the landfill cover and from hauling waste from the Base that would need to be collected and then transported off Base. Post-closure noise would be

related to activities required for the maintenance of the prescriptive final cover and erosion control, landfill gas monitoring and well maintenance, groundwater monitoring and well maintenance, drainage improvements, access and security, and site administration. All impacts would be negligible and not significant.

4.7.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

Noise associated with implementation of Alternative 2 would be essentially the same as for Alternative 1, with slight changes in traffic patterns associated with bringing the Base waste to the MBAL transfer station and then hauling it off Base. All impacts would be negligible and not significant.

4.7.4 Alternative 3 – Fewer Operating Days

As with Alternative 1, this alternative would not have any significant impacts on existing noise receptors in the vicinity of Edwards AFB. There would be fewer days of traffic-related noise associated with the MBAL but overall, this difference would not be noticeable. Impacts would be negligible and not significant.

4.7.5 Alternative 4 – Vertical Expansion of the Landfill

With Alternative 4, additional waste would be disposed of at the MBAL but operations would stay essentially the same and the life of the landfill would be greatly extended. Some negligible increase in activity could occur at the landfill as it is expanded vertically. However, impacts would be negligible and not significant.

4.7.6 No Action Alternative

Under the No-Action Alternative, the MBAL would continue its current operation with no changes. As a result, there would be no additional noise impacts and, therefore, no mitigation measures would be required.

4.8 SOCIOECONOMICS

4.8.1 Methodology and Significance Criteria

Socioeconomic impacts would be considered significant if they substantially altered the location and distribution of the population within the region of influence (ROI); caused the population to exceed historic growth rates; decreased jobs so as to substantially raise the regional unemployment rates or reduce income generation; substantially affected the local housing market and vacancy rates; or resulted in the need for new social services and support facilities.

4.8.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

Closure of the landfill would not create significant impacts to socioeconomics in the on- or off-base region. The project would, however, generate a very small number of temporary jobs, which would be a beneficial impact on economic conditions in the area. A very slight increase in local revenues would be expected to occur as a result of money spent for construction materials and daily services. It is not expected that this increase would measurably affect housing or schools in the area.

4.8.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

Socioeconomic impacts associated with implementation of Alternative 2 would be essentially the same as for Alternative 1, with slight differences due to the addition of a transfer station at the MBAL. All impacts would be negligible and not significant.

4.8.4 Alternative 3 – Fewer Operating Days

Under Alternative 3, the amount of waste being disposed of at the MBAL would not change and, therefore, the only changes to occur would be related to the fewer operating days. It is likely that the number of overall trips that would be needed to collect the waste would be about the same as under current conditions. No socioeconomic impacts would occur.

4.8.5 Alternative 4 – Vertical Expansion of the Landfill

With Alternative 4, additional waste would be disposed of at the MBAL but operations would stay essentially the same and the life of the landfill would be greatly extended. Some negligible increase in activity could occur at the landfill as it is expanded vertically. However, socioeconomic impacts would be negligible and not significant.

4.8.6 No Action Alternative

Under the No-Action Alternative, the MBAL would continue its current operation with no changes. As a result, there would be no socioeconomic impacts and, therefore, no mitigation measures would be required.

4.9 HYDROLOGY AND WATER QUALITY

4.9.1 Methodology and Significance Criteria

None of the alternatives would result in an increase in groundwater withdrawal at Edwards AFB. None would substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. The alternatives in which the MBAL would close and the landfill permanently covered would reduce the need for water (in the long term) used as dust suppression thereby reducing water use and reliance on groundwater sources. In addition, because the MBAL is not within a flood zone area (refer to Figure 3-1), no related impacts would occur. As a result, further analysis of groundwater resources is not necessary.

To evaluate project-related impacts to water resources, the proposed alternatives were reviewed for their proposed actions related to potential impacts to water quality due to potential impacts to ephemeral drainages as well as potential flooding hazards. The evaluation of potential impacts on water resources is based on each alternative's potential to affect water quality, surface water runoff volumes and drainage patterns, and flood hazards. Any selected alternative would have a significant impact on hydrology and water resources if it would:

- Violate any groundwater quality standards or waste discharge requirements, as defined by the Lahontan Region of the RWQCB;

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a wash, in a manner that would result in substantial erosion or siltation on- or off-site;
- Substantially increase the potential for flooding or the amount of damage that could result from flooding, including flooding; or
- Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff.

4.9.2 Alternative 1 – Closure of Landfill and Off-Site Transportation and Disposal

For this alternative, the MBAL would be closed according to appropriate requirements in compliance with closure and post-closure maintenance requirements as promulgated by the CalRecycle and the SWRCB. In particular, as discussed in Section 1.4 (Regulatory Requirements), regulatory requirements for closing the landfill include issuance of closure waste discharge requirements (WDRs) by the Regional Water Quality Control Board (RWQCB), Lahontan Region, pursuant to CCR, Title 27. In addition, prior to issuance of any discretionary permits related to closure, the RWQCB may require compliance with the California Environmental Quality Act (CEQA) to identify specific impacts associated with closure. These permits and the associated CEQA document would be prepared at the time that Edwards AFB decides to close the landfill.

After closure, the landfill would receive regular inspection, maintenance and monitoring activities. Following closure, all waste from Edwards AFB would be transported to off-base landfills for disposal.

Closure of the MBAL has the potential for impacting local water quality due to wind and water erosion. Sporadic heavy rainfall events that occur in the vicinity of Edwards AFB can result in brief episodes of surface runoff in shallow erosion gullies and depressions in the ground surface. Run-on to the landfill area, regionally from the northeast to the southwest, may reach the landfill/balefill (Table 4-1). This run-on would be diverted around the in-place waste with daily cover material.

To prevent post-closure run-on of storm water from impacting the landfill area during and following a major rainfall event, a drainage interception system along the northeastern side of the

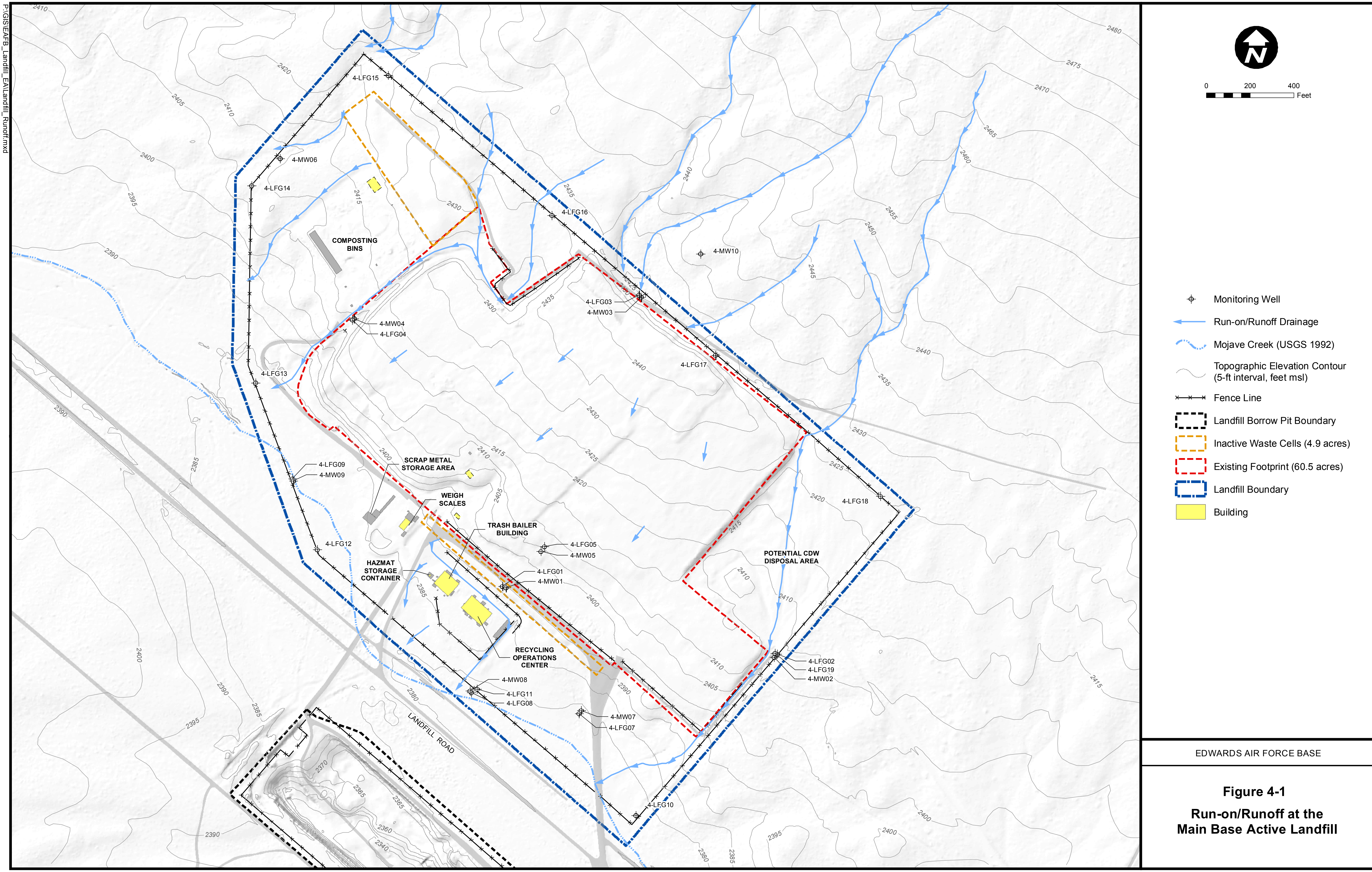
balefill and the existing landfill has been proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road (U.S. Air Force 2014b). The system, designed to handle a 100-year, 24-hour storm, would collect off-site run-on from the upland drainage by use of interception channels that would divert the flow around the site. Closure of the landfill would be subject to the requirements of Air Force Instruction 32-1067, Water and Fuel Systems and Title 27 CCR, Section 20365, and may include future preparation of a Storm Water Pollution Prevention Plan (SWPPP) or National Pollutant Discharge Elimination System (NPDES) permit, as identified in MM HYD-1.

Impacts to riverine systems in proximity to the landfill would be avoided where feasible. This includes keeping equipment staging areas in upland areas outside stream channels. Best Management Practices (BMPs) to reduce impacts from erosion to water quality would be identified in the closure WDR permit. Some generic BMPs may include: silt fences, fiber rolls, sediment/infiltration basins, and hydroseeding/vegetation establishment.

Implementation of **MM HYD-1** and MM HYD-2 would reduce potential water quality impacts from the project due to erosion to a level that is not significant.

MM HYD-1: The selected alternative may require a Storm Water Pollution Prevention Plan (SWPPP) in support of a National Pollutant Discharge Elimination System (NPDES) permit in connection with closure activities. Implementation of a SWPPP would ensure downstream water quality as sediment erosion would be controlled and sediment movement from the proposed alternative during construction would be reduced.

MM-HYD-2: The selected alternative will require issuance of closure WDRs by the RWQCB pursuant to CCR, Title 27 to identify potential impacts to regulated waters as well as associated impact minimization measures. Where feasible, impacts to regulated waters would be avoided and BMPs for reducing erosion impacts to water quality would be identified and implemented.



EDWARDS AIR FORCE BASE

Figure 4-1

Run-on/Runoff at the Main Base Active Landfill

4.9.3 Alternative 2 – Closure of Landfill and Use of an On-Base Transfer Station with Off-Site Disposal

Under Alternative 2, closure of the MBAL would be the same as described for Alternative 1, but instead of hauling all waste directly to off-base landfills, the waste would be brought to the MBAL site for sorting and consolidation before transfer and final disposal off base. Water quality impacts would be the same as for Alternative 1.

Implementation of **MM HYD-1** and MM HYD-2 would reduce potential water quality impacts from the project due to erosion to a level that is not significant.

4.9.4 Alternative 3 – Fewer Operating Days

The decreased operational days at the MBAL associated with Alternative 3 would not change activities at the MBAL and, therefore, would not change overall runoff from existing conditions. Therefore, no impacts would occur as a result of this alternative and no mitigation would be required.

4.9.5 Alternative 4 – Vertical Expansion of the Landfill

Vertical expansion of the MBAL has the potential for impacting local surface water quality. As with Alternatives 1 and 2, an appropriate design in accordance with CCR, Title 27 would need to be included to control stormwater runoff from the landfill, preventing erosion and impacts to surface water quality.

Implementation of **MM HYD-1** would reduce potential impacts from the project for water quality due to erosion during vertical expansion of the MBAL to a level that is not significant.

4.9.6 No Action Alternative

Under the No-Action Alternative, the MBAL would continue its current operation with no changes. No impacts to water quality and flood zones would occur and, therefore, no mitigation would be required.

4.10 CUMULATIVE IMPACTS

The CEQ regulations define “cumulative impact” as the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The region of influence (ROI) for the cumulative impact analysis includes Edwards AFB for all resources, except for transportation-related impacts which extend beyond the Base boundaries. Under the Proposed Action, solid waste at Edwards AFB would be collected in the same way as under current conditions but would be transported off-Base. Because so few trucks are used for collection of waste at the Base and the number of overall trips is so small, this would not result in appreciable changes in traffic in the project area. For air quality and greenhouse gases, emissions would be temporary and significantly below established thresholds and, therefore, no mitigation or minimization measures are needed. For biological and cultural resources, no new areas would be affected by the Proposed Action in the short term. If the closure alternative is selected, preconstruction surveys for biological and cultural resources would be conducted for possible nesting impacts and impacts to cultural resources where drainage improvements may occur, respectively. These impacts would be reduced to a level that is not significant with the incorporation of minimization measures. Impacts related to geology and soils, hazardous materials and waste, infrastructure, noise, and socioeconomics would be localized and negligible. Hydrology and water quality impacts resulting from potential erosion would also be localized and would be reduced to less than significant levels with the incorporation of standard erosion and drainage control measures as would be found in a SWPPP, and as would be required by the RWQCB permits and other CalRecycle compliance requirements needed for closure or vertical expansion of the landfill. In conclusion, because most project-related impacts are localized and none would be significant and, in fact, would all be substantially below a level of significance, there would be no impacts that would contribute to cumulative impacts in the area.

4.11 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts include those that are negative, occurring regardless of any identified environmental protection measures or mitigation measures. All adverse impacts associated with the Proposed Action and the Alternatives would not be significant or would be reduced to a level that is not significant, as discussed in Sections 4.1 through 4.9. The impacts for each resource are summarized here.

4.11.1 Air Quality and Greenhouse Gases

Construction and operational emissions for all alternatives would be well below significance thresholds and would not be significant. Incorporation of minimization measures MM AQ-1 and MM AQ-2 to minimize fugitive dust emissions and to ensure compliance with state off-road regulations would further reduce air quality and greenhouse gas emissions.

4.11.2 Cultural Resources

The waste footprint as well as the supporting landfill activities area would not expand beyond current boundaries with any of the alternatives. The project site is enclosed by a fence and the entire area is disturbed by existing landfill activities. After closure, the landfill would require regular inspection, maintenance, and monitoring activities. Because, the landfill area has already been extensively disturbed by ongoing landfill activities, and no new areas would be disturbed, it is unlikely that there would be any impacts to cultural resources with this alternative. There is a small potential for inadvertent discoveries during final grading of the site. However, with incorporation of minimization measure (MM) CUL-1, no impacts to cultural resources are anticipated.

MM CUL-1: Although the areas to the west, south, and east surrounding the MBAL have been previously surveyed for archaeological resources, those surveys are now over 10 years old and areas that may be affected by closure of the landfill will require re-survey. The area to the north of the MBAL has never been surveyed for archaeological sites. Therefore, up to approximately 300 acres of archaeological survey will need to be conducted on the west, north, and east sides of the MBAL. If avoidance of any newly recorded archaeological sites is not feasible then those

sites will be subject to evaluation to determine their eligibility to the National Register and subsequent treatment in accordance with Section 106 of the National Historic Preservation Act. In the unlikely event that subsurface archaeological resources are discovered, work will cease immediately in the area and the Base Historic Preservation Officer (BHPO) will be contacted. A records search for any landscapes or traditional cultural properties will also be conducted by contacting the Native American Heritage Commission as well as the four federally-recognized tribes affiliated with Edwards AFB.

4.11.3 Geology and Soils

No significant impacts related to geology or seismicity would occur with any of the alternatives and no mitigation measures are required. There is the potential for wind or water erosion of soil to occur at the landfill. With incorporation of MM GEO-1, these impacts would be kept to a level that is not significant.

MM GEO-1: Controls such as the use of water to reduce dust and stormwater control devices such as the installation of a drainage interception along the northeastern side of the balefill and the existing landfill is proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road. The system, designed to handle a 100-year, 24-hour storm, would collect off-site run-on from the upland drainage by use of interception channels that will divert the flow around the site (Edwards AFB 2015a).

4.11.4 Hazardous Materials and Hazardous Waste

For the closure alternatives, the MBAL would be closed in accordance with current State of California requirements. Following closure, all waste from Edwards AFB would be transported to off-base landfills for disposal and the closed landfill would be subject to regular inspection, maintenance and monitoring activities.

Implementation of any of the alternatives would not mobilize existing contaminants associated with MBAL Site 4 in groundwater, or expose workers to contaminated soils or groundwater at levels in excess of those permitted by federal and state law. Hazardous materials necessary for

project implementation that require temporary storage at the construction area would comply with relevant Edwards AFB requirements.

Implementation of MM HAZ-1 would further reduce potential hazards to workers from hazardous materials or hazardous waste during landfill closure activities to a level that is not significant.

MM HAZ-1: Prior to construction activities associated with the landfill closure, a health and safety plan in compliance with 29 CFR 1910.120 will be prepared and approved by Edwards AFB. The site-specific health and safety plan will address all site-specific safety and environmental hazards that have the potential to be encountered during construction of the alternative, including physical hazards, biological hazards, and general safety hazards. Any training required by construction personnel will be identified.

4.11.5 Infrastructure

There would be a long-term, minor decrease in the need for infrastructure utilities, and there would be a long-term increase in vehicular traffic off the Base due to transport of materials from the MBAL to an off-Base landfill. No significant impacts to infrastructure would occur and, therefore, no mitigation or minimization measures would be required.

4.11.6 Natural Resources

No native vegetation or wildlife communities would be directly removed, nor sensitive species directly affected because the landfill area has already been disturbed by existing landfill activities and is surrounded by a fence, and all closure activities at the MBAL would take place within the already fenced area. Construction and monitoring activities associated with the landfill closure could have direct and temporary impacts to nesting birds, including possibly burrowing owls and other sensitive bird species, considered a significant impact if they were in violation of the federal MBTA. Implementation of MM NR-1 would avoid these impacts.

Indirect temporary impacts associated with closure activities or ongoing monitoring and maintenance activities may include locally increased noise and dust. Because the MBAL

currently supports activities that create noise and ambient dust conditions exist in the Mojave Desert, the temporary increase of these factors in localized areas for the closure activities is expected to be minimal. This impact is expected to be less than significant and requires no avoidance and minimization measures.

With the incorporation of **MM NR-1** into the project, no significant natural resources impacts are likely to occur.

MM NR-1: Pre-construction surveys will be conducted during nesting season to ensure compliance with the federal MBTA and avoid nesting impacts to burrowing owls and other bird species. These surveys will be conducted no more than 30 days in advance of initial disturbance. If the project impacts are to occur during the breeding season and owls or nesting birds are found occupying habitat within the disturbance area, disturbance of nests will not occur when active nests contain eggs or fledglings. If the project impacts are to occur outside of the breeding season and owls or other nesting birds are found occupying habitat within the disturbance area, passive relocation (via one-way doors and collapse of burrows) will occur. If no active nests are found within the disturbance area during the pre-construction surveys, the proposed disturbance activities may proceed.

4.11.7 Noise

Noise associated would primarily result from vehicles used during the transport of soil for constructing the landfill cover and from hauling waste from the Base that would need to be collected and then transported off Base. Post-closure noise would be related to activities required for the maintenance of the prescriptive final cover and erosion control, landfill gas monitoring and well maintenance, groundwater monitoring and well maintenance, drainage improvements, access and security, and site administration. All impacts would be negligible and not significant.

4.11.8 Socioeconomics

Closure of the landfill would not create significant impacts to socioeconomics in the on- or off-base region, although it would generate a very small number of temporary jobs, which would be

a beneficial impact on economic conditions in the area. A very slight increase in local revenues would be expected to occur as a result of money spent for construction materials and daily services. This increase would not measurably affect housing or schools in the area. All impacts would be negligible and not significant.

4.11.9 Hydrology and Water Quality

Closure of the MBAL has the potential for impacting local water quality due to wind and water erosion. Sporadic heavy rainfall events that occur in the vicinity of Edwards AFB can result in brief episodes of surface runoff in shallow erosion gullies and depressions in the ground surface. Run-on to the landfill area, regionally from the northeast to the southwest, may reach the landfill/balefill. This run-on would be diverted around the in-place waste with daily cover material.

To prevent post-closure run-on of storm water from impacting the landfill area during and following a major rainfall event, a drainage interception system along the northeastern side of the balefill and the existing landfill has been proposed to direct any surface water run-on to the northwest and southeast of the landfill, and then southwesterly toward Landfill Road (U.S. Air Force 2014b). The system would be designed to handle a 100-year, 24-hour storm and would collect off-site run-on from the upland drainage by use of interception channels that would divert the flow around the site. Current landfill operations are subject to Air Force Instruction 32-1067, Water and Fuel Systems and Title 27 CCR, Section 20365. A SWPPP may be prepared for closure activities, and may include development of the drainage improvements, and may be required at the discretion of the RWQCB.

Impacts to riverine systems in proximity to the landfill would be avoided where feasible. This includes keeping equipment staging areas in upland areas outside stream channels. Best Management Practices (BMPs) to reduce impacts from erosion to water quality would be identified in the closure WDR permit. Some generic BMPs may include: silt fences, fiber rolls, sediment/infiltration basins, and hydroseeding/vegetation establishment.

Implementation of **MM HYD-1** and MM HYD-2 would reduce potential water quality impacts from the project due to erosion to a level that is not significant.

MM HYD-1: The selected alternative may require a Storm Water Pollution Prevention Plan (SWPPP) in support of a National Pollutant Discharge Elimination System (NPDES) permit in connection with closure activities. Implementation of a SWPPP would ensure downstream water quality as sediment erosion would be controlled and sediment movement from the proposed alternative during construction would be reduced.

MM-HYD-2: The selected alternative will require issuance of closure WDRs by the RWQCB pursuant to CCR, Title 27 to identify potential impacts to regulated waters as well as associated impact minimization measures. Where feasible, impacts to regulated waters would be avoided and BMPs for reducing erosion impacts to water quality would be identified and implemented.

4.12 SHORT-TERM VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

Examples of short-term uses of the environment include direct, construction-related disturbances and direct impacts associated with an increase in population and activity that occurs over a period typically less than 5 years. Long-term uses of the environment include impacts occurring over a period of more than 5 years, including permanent resource loss.

Implementation of any of the solid waste management alternatives would not result in any changes in use at Edwards AFB and, therefore, there would be no long-term changes in population or productivity of the environment as a result of this project.

4.13 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

In accordance with NEPA (40 CFR 1502.16), this section includes a discussion of any irreversible and irretrievable commitment of resources associated with the Proposed Action. Irreversible and irretrievable resource commitments are related to the use of nonrenewable natural resources and the effects that the use of those resources will have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g.,

energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of implementing an action (e.g., extinction of a rare or threatened species, or the disturbance of an important cultural resource site).

Implementation of any of the proposed solid waste management alternatives would not require an irreversible or irretrievable commitment of resources.

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6.0 LIST OF AGENCIES AND ORGANIZATIONS TO WHOM COPIES OF THE ENVIRONMENTAL ASSESSMENT ARE SENT

AFTC Technical Library
812 TSS/ENTL
Edwards AFB, CA 93524

Edwards Base Library
412 FSS/FSDL
5 West Yeager Blvd., Building 2665
Edwards AFB, CA 93524

Palmdale City Library
E. Palmdale Boulevard
Palmdale, CA 93550

Los Angeles County Library
Lancaster Branch
601 W. Lancaster Boulevard
Lancaster, CA 93534

Kern County Library
Wanda Kirk Branch
3611 Rosamond Boulevard
Rosamond, CA 93560

Kern County Library
Mojave Branch
16916-1/2 Highway 14
Mojave, CA 93501

Kern County Library
Boron Branch
26967 20 Mule Team Road
Boron, CA 93516

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8.0 ACRONYMS AND ABBREVIATIONS

ADP	Area Development Plan
AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFRL	Air Force Research Laboratory
AICUZ	Air Installation Compatible Use Zone
AMSL	Above mean sea level
APCD	air pollution control district
APE	Area of Potential Effect
ARB	Air Resources Board
AVEK	Antelope Valley East Kern (Water Agency)
BO	Biological Opinion
BP	Before present
°C	Celsius
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Estimator Model
CalOSHA	California Federal Occupational Safety and Health Act
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCR	California Code of Regulations
C&D	construction and demolition
CDFW	California Department of Fish and Wildlife
CY	cubic yards
CEG	Civil Engineer Group
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulation
CH_4	Methane
CNEL	Community Noise Equivalent Level
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent mass
COPC	Contaminant of Potential Concern
CRHP	California Registration of Historic Places
CRP	Compliance Restoration Program
CRWQCB	California Regional Water Quality Control Board
dB	Decibel
DoD	Department of Defense
DoDI	Department of Defense Instruction
DTSC	Department of Toxic Substances Control
EA	Environmental Assessment

EKAPCD	Eastern Kern Air Pollution Control District
EO	Executive Order
EPA	United States Environmental Protection Agency (USEPA)
ERP	Environmental Restoration Program
FFA	Federal Facilities Agreement
GHG	Greenhouse gas
GWP	Global warming potential
H_2S	hydrogen sulfide
HazMER	Hazardous Material Excess Reutilization Program
HFCs	Hydrofluorocarbons
HHW	household hazardous waste
HW	hazardous waste
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
kV	Kilovolt
MBAL	Main Base Active Landfill
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant levels
MDAB	Mojave Desert Air Basin
MFH	Military Family Housing
$\mu g/m^3$	Micrograms per cubic meter
MSL	Mean sea level
MSW	Municipal solid waste
$MTCO_{2e}$	Metric tons of CO_2-equivalent mass
N/A	Not applicable
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NASA	National Aeronautical Space Administration
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
N_2O	Nitrous oxide
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
O_3	Ozone
OSHA	Federal Occupational Safety and Health Act
OU	Operable Unit
PA	Programmatic Agreement
Pb	Lead
PCPCMP	Preliminary Closure and Post-Closure Maintenance Plan
PFCs	Perfluorocarbons
PG&E	Pacific Gas & Electric

$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
PM_{10}	Respirable particulate matter less than 10 microns in diameter
ppb	Parts per billion
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
RI	Remedial Investigation
ROC	recycling operations center
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCE	Southern California Edison
SF_6	Sulfur hexafluoride
SO_2	Sulfur dioxide
SO_4	Sulfates
SR	California State Route
SWFP	Solid Waste Facility Permit
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCP	Traditional Cultural Property
TOSCA	Toxic Substance Control Act
tpy	Tons per year
TW	Test wing
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UW	Universal waste
UXO	Unexploded ordinance
VOC	Volatile Organic Compounds
WEAP	Worker environmental awareness program
WWTP	Wastewater treatment plant

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APPENDICES

APPENDIX A – Cost Comparison of Solid Waste Management Alternatives

APPENDIX A
COST COMPARISON OF SOLID WASTE MANAGEMENT ALTERNATIVES
JULY 2016

COST CATEGORY	Alternative 1 Closure and Off-Site Disposal	Alternative 2 Closure and Transfer Station	Alternative 3 Fewer Operating Days	Alternative 4 Vertical Expansion	Alternative 5 No Action	Notes/Remarks
Closure using alternative cover (short-term and one time cost)	$5,512,687	$5,512,687	NA	NA	NA	Closure would eventually be required in the long-term under Alternatives 3, 4 and 5
Long-Term Maintenance (annual)	$383,586	$383,586	NA	NA	NA	Annual costs over 30 years
Operational Costs (annual)	$383,586 $11,507,586/30 years	$383,586 $11,507,586/30 years	$1,541,060	$1,140,066	$1,460,167	--For Alternatives 1 and 2, need to factor in operational costs for the years before closure --Vertical expansion costs are conservative --No Action costs include operational and environmental costs
Off-Site Disposal (annual)	$497,247	$497,247	NA	NA	NA	Off-site disposal costs taken from Final Concrete EUL EA Expansion to PREIAP Technical Feasibility Study for Integrated Solid Waste Management, Recycling, and Main Base Active Landfill at Edwards Air Force Base, July 2015 (Feasibility Study) (Tetra Tech, 2015)
Transfer Station (annual)	NA	NA-Determined to be cost prohibitive.	NA	NA	NA	Feasibility Study indicates that transfer station is prohibitively expensive
New Permits	NA	NA	NA	$300,000 (estimated)	NA	Permitting costs are estimated and would require scoping if Alternative 4 was selected.
Other						
TOTAL: **--One-time costs** **--Annual costs**	**$5,512,687** **$880,833**	**$5,512,687** **$383,586** **(plus unknown transfer station costs)**	**None** **$1,541,060**	**$300,000 (estimated)** **$1,140,060**	**None** **$1,460,167**	

NA = Not Applicable

APPENDIX B – Air Quality Calculations

APPENDIX B – 1

Alternative 1: Landfill Closure and Off-Site Disposal Operations and Construction Calculations

Edwards AFB Landfill Closure EA
Operation Emissions resulting from houling solid waste from MBAL to off-site landfill

Vehicle Type	HDDV
Trips per day	2
Days per year	260
Trips per year	520
Round Trip Length (miles)	44
Miles per year	22,880

Criteria Pollutant	ROG	Nox	CO	SO2	PM10	PM2.5	CO2	NH3	CO2e
Emission Factors (g/mi)	0.264	1.189	0.416	0.012	0.059	0.034	1244.2	0.027	
Emissions (lb/yr)	13.32	59.99	20.99	0.61	2.98	1.72	62,770.39	1.36	62,771.75
Emissions (tpy)	0.01	0.03	0.01	0.00	0.00	0.00	31.39	0.00	31.39
Emissions (lb/day)	0.1	0.2	0.1	0.0	0.0	0.0	241.4	0.0	241.39

Edwards AFB Landfill Closure

Kern-Mojave Desert County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	65.50	Acre	65.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	32
Climate Zone	7			**Operational Year**	2021
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - No new structures (square footage) planned that would require architechtural coating.

Construction Phase - Tatal days as estimated by the civil engineer

Off-road Equipment - Values estimated as entered

Off-road Equipment - Estimates as entered

Off-road Equipment - Equiment amounts estimated by civil project engineer

Off-road Equipment - Values estimated by project civil engineer

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Construction Off-road Equipment Mitigation - Tier 3

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3

tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
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tblConstructionPhase	NumDays	70.00	10.00
tblConstructionPhase	NumDays	110.00	73.00
tblConstructionPhase	NumDays	40.00	7.00
tblConstructionPhase	PhaseEndDate	6/16/2020	6/15/2020
tblConstructionPhase	PhaseStartDate	5/6/2020	5/5/2020
tblGrading	AcresOfGrading	182.50	275.00
tblGrading	AcresOfGrading	0.00	33.00
tblGrading	MaterialImported	0.00	270,000.00
tblLandUse	LandUseSquareFeet	2,853,180.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
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tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	PhaseName		Site Preparation
tblOffRoadEquipment	PhaseName		Site Preparation
tblOffRoadEquipment	PhaseName		Storm Drains and Perimeter Road
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	PhaseName		Storm Drains and Perimeter Road
tblOffRoadEquipment	UsageHours	8.00	5.00
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	7.50
tblOnRoadDust	VendorPercentPave	100.00	50.00
tblOnRoadDust	VendorPercentPave	100.00	50.00
tblOnRoadDust	VendorPercentPave	100.00	50.00
tblProjectCharacteristics	OperationalYear	2014	2021
tblTripsAndVMT	HaulingTripLength	20.00	10.00
tblTripsAndVMT	HaulingTripNumber	33,750.00	17,419.00
tblTripsAndVMT	VendorTripLength	7.30	2.00
tblTripsAndVMT	VendorTripLength	7.30	2.00
tblTripsAndVMT	VendorTripLength	7.30	2.00
tblTripsAndVMT	VendorTripLength	7.30	37.00
tblTripsAndVMT	VendorTripNumber	0.00	8.00
tblTripsAndVMT	VendorTripNumber	0.00	8.00

tblTripsAndVMT	VendorTripNumber	0.00	8.00
tblTripsAndVMT	VendorTripNumber	0.00	4.00
tblTripsAndVMT	WorkerTripNumber	0.00	8.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.3076	2.7877	3.6272	5.9700e-003	1.1350	0.1085	1.2435	0.2986	0.1000	0.3987	0.0000	510.8504	510.8504	0.0696	0.0000	512.3120
Total	**0.3076**	**2.7877**	**3.6272**	**5.9700e-003**	**1.1350**	**0.1085**	**1.2435**	**0.2986**	**0.1000**	**0.3987**	**0.0000**	**510.8504**	**510.8504**	**0.0696**	**0.0000**	**512.3120**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.1806	1.9107	3.4819	5.9700e-003	0.8246	0.0677	0.8923	0.1741	0.0662	0.2403	0.0000	510.8501	510.8501	0.0696	0.0000	512.3118
Total	**0.1806**	**1.9107**	**3.4819**	**5.9700e-003**	**0.8246**	**0.0677**	**0.8923**	**0.1741**	**0.0662**	**0.2403**	**0.0000**	**510.8501**	**510.8501**	**0.0696**	**0.0000**	**512.3118**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**41.29**	**31.46**	**4.00**	**0.00**	**27.35**	**37.61**	**28.25**	**41.71**	**33.84**	**39.73**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	6.0000e-005	1.0000e-005	6.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1700e-003	1.1700e-003	0.0000	0.0000	1.2400e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**6.0000e-005**	**1.0000e-005**	**6.0000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**1.1700e-003**	**1.1700e-003**	**0.0000**	**0.0000**	**1.2400e-003**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	6.0000e-005	1.0000e-005	6.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1700e-003	1.1700e-003	0.0000	0.0000	1.2400e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**6.0000e-005**	**1.0000e-005**	**6.0000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**1.1700e-003**	**1.1700e-003**	**0.0000**	**0.0000**	**1.2400e-003**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2020	1/14/2020	5	10	
2	Site Preparation	Site Preparation	1/15/2020	1/23/2020	5	7	
3	Grading	Grading	1/24/2020	5/5/2020	5	73	
4	Storm Drains and Perimeter Road	Building Construction	5/5/2020	6/15/2020	5	30	

Acres of Grading (Site Preparation Phase): 33

Acres of Grading (Grading Phase): 275

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	1	5.00	162	0.38
Demolition	Rubber Tired Dozers	1	5.00	255	0.40
Site Preparation	Off-Highway Tractors	1	8.00	122	0.44
Site Preparation	Off-Highway Trucks	1	8.00	400	0.38
Site Preparation	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Grading	Excavators	0	8.00	162	0.38
Grading	Graders	1	4.00	174	0.41
Grading	Plate Compactors	2	4.50	8	0.43
Grading	Rubber Tired Dozers	2	6.00	255	0.40
Grading	Scrapers	3	6.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	7.50	97	0.37
Storm Drains and Perimeter Road	Cranes	0	7.00	226	0.29
Storm Drains and Perimeter Road	Forklifts	0	8.00	89	0.20
Storm Drains and Perimeter Road	Generator Sets	0	8.00	84	0.74
Storm Drains and Perimeter Road	Other Construction Equipment	1	8.00	171	0.42
Storm Drains and Perimeter Road	Pumps	1	4.00	84	0.74
Storm Drains and Perimeter Road	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Storm Drains and Perimeter Road	Welders	0	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	3	8.00	8.00	85.00	10.80	2.00	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	4	10.00	8.00	0.00	10.80	2.00	20.00	LD_Mix	HDT_Mix	HHDT
Grading	10	25.00	8.00	17,419.00	10.80	2.00	10.00	LD_Mix	HDT_Mix	HHDT
Storm Drains and Perimeter Road	3	8.00	4.00	0.00	10.80	37.00	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Clean Paved Roads

3.2 Demolition - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					9.3400e-003	0.0000	9.3400e-003	1.4100e-003	0.0000	1.4100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.8800e-003	0.0559	0.0537	8.0000e-005		2.8200e-003	2.8200e-003		2.6800e-003	2.6800e-003	0.0000	6.5888	6.5888	1.4300e-003	0.0000	6.6188
Total	**5.8800e-003**	**0.0559**	**0.0537**	**8.0000e-005**	**9.3400e-003**	**2.8200e-003**	**0.0122**	**1.4100e-003**	**2.6800e-003**	**4.0900e-003**	**0.0000**	**6.5888**	**6.5888**	**1.4300e-003**	**0.0000**	**6.6188**

3.2 Demolition - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.4000e-004	5.8200e-003	0.0109	3.0000e-005	7.3000e-004	1.3000e-004	8.7000e-004	2.0000e-004	1.2000e-004	3.3000e-004	0.0000	2.6692	2.6692	2.0000e-005	0.0000	2.6696
Vendor	2.7000e-004	1.0900e-003	5.1900e-003	0.0000	0.0538	1.0000e-005	0.0538	5.3700e-003	1.0000e-005	5.3800e-003	0.0000	0.2582	0.2582	0.0000	0.0000	0.2583
Worker	9.0000e-005	1.4000e-004	1.1800e-003	0.0000	3.2000e-004	0.0000	3.2000e-004	9.0000e-005	0.0000	9.0000e-005	0.0000	0.2386	0.2386	1.0000e-005	0.0000	0.2389
Total	**1.1000e-003**	**7.0500e-003**	**0.0172**	**3.0000e-005**	**0.0548**	**1.4000e-004**	**0.0550**	**5.6600e-003**	**1.3000e-004**	**5.8000e-003**	**0.0000**	**3.1660**	**3.1660**	**3.0000e-005**	**0.0000**	**3.1667**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					4.2000e-003	0.0000	4.2000e-003	6.4000e-004	0.0000	6.4000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.7100e-003	0.0352	0.0465	8.0000e-005		1.8800e-003	1.8800e-003		1.8800e-003	1.8800e-003	0.0000	6.5887	6.5887	1.4300e-003	0.0000	6.6188
Total	**1.7100e-003**	**0.0352**	**0.0465**	**8.0000e-005**	**4.2000e-003**	**1.8800e-003**	**6.0800e-003**	**6.4000e-004**	**1.8800e-003**	**2.5200e-003**	**0.0000**	**6.5887**	**6.5887**	**1.4300e-003**	**0.0000**	**6.6188**

3.2 Demolition - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	7.4000e-004	5.8200e-003	0.0109	3.0000e-005	7.3000e-004	1.3000e-004	8.7000e-004	2.0000e-004	1.2000e-004	3.3000e-004	0.0000	2.6692	2.6692	2.0000e-005	0.0000	2.6696
Vendor	2.7000e-004	1.0900e-003	5.1900e-003	0.0000	0.0538	1.0000e-005	0.0538	5.3700e-003	1.0000e-005	5.3800e-003	0.0000	0.2582	0.2582	0.0000	0.0000	0.2583
Worker	9.0000e-005	1.4000e-004	1.1800e-003	0.0000	3.2000e-004	0.0000	3.2000e-004	9.0000e-005	0.0000	9.0000e-005	0.0000	0.2386	0.2386	1.0000e-005	0.0000	0.2389
Total	**1.1000e-003**	**7.0500e-003**	**0.0172**	**3.0000e-005**	**0.0548**	**1.4000e-004**	**0.0550**	**5.6600e-003**	**1.3000e-004**	**5.8000e-003**	**0.0000**	**3.1660**	**3.1660**	**3.0000e-005**	**0.0000**	**3.1667**

3.3 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0597	0.0000	0.0597	0.0251	0.0000	0.0251	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.9400e-003	0.1026	0.0795	1.2000e-004		4.5300e-003	4.5300e-003		4.1700e-003	4.1700e-003	0.0000	10.9420	10.9420	3.5400e-003	0.0000	11.0163
Total	**9.9400e-003**	**0.1026**	**0.0795**	**1.2000e-004**	**0.0597**	**4.5300e-003**	**0.0642**	**0.0251**	**4.1700e-003**	**0.0292**	**0.0000**	**10.9420**	**10.9420**	**3.5400e-003**	**0.0000**	**11.0163**

3.3 Site Preparation - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.9000e-004	7.6000e-004	3.6300e-003	0.0000	0.0376	1.0000e-005	0.0376	3.7600e-003	1.0000e-005	3.7700e-003	0.0000	0.1807	0.1807	0.0000	0.0000	0.1808
Worker	8.0000e-005	1.2000e-004	1.0300e-003	0.0000	2.8000e-004	0.0000	2.8000e-004	7.0000e-005	0.0000	8.0000e-005	0.0000	0.2088	0.2088	1.0000e-005	0.0000	0.2090
Total	**2.7000e-004**	**8.8000e-004**	**4.6600e-003**	**0.0000**	**0.0379**	**1.0000e-005**	**0.0379**	**3.8300e-003**	**1.0000e-005**	**3.8500e-003**	**0.0000**	**0.3896**	**0.3896**	**1.0000e-005**	**0.0000**	**0.3898**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0268	0.0000	0.0268	0.0113	0.0000	0.0113	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0300e-003	0.0587	0.0694	1.2000e-004		2.3000e-003	2.3000e-003		2.3000e-003	2.3000e-003	0.0000	10.9420	10.9420	3.5400e-003	0.0000	11.0163
Total	**3.0300e-003**	**0.0587**	**0.0694**	**1.2000e-004**	**0.0268**	**2.3000e-003**	**0.0291**	**0.0113**	**2.3000e-003**	**0.0136**	**0.0000**	**10.9420**	**10.9420**	**3.5400e-003**	**0.0000**	**11.0163**

3.3 Site Preparation - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.9000e-004	7.6000e-004	3.6300e-003	0.0000	0.0376	1.0000e-005	0.0376	3.7600e-003	1.0000e-005	3.7700e-003	0.0000	0.1807	0.1807	0.0000	0.0000	0.1808
Worker	8.0000e-005	1.2000e-004	1.0300e-003	0.0000	2.8000e-004	0.0000	2.8000e-004	7.0000e-005	0.0000	8.0000e-005	0.0000	0.2088	0.2088	1.0000e-005	0.0000	0.2090
Total	**2.7000e-004**	**8.8000e-004**	**4.6600e-003**	**0.0000**	**0.0379**	**1.0000e-005**	**0.0379**	**3.8300e-003**	**1.0000e-005**	**3.8500e-003**	**0.0000**	**0.3896**	**0.3896**	**1.0000e-005**	**0.0000**	**0.3898**

3.4 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.4955	0.0000	0.4955	0.2000	0.0000	0.2000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1619	1.7863	1.2848	2.0600e-003		0.0791	0.0791		0.0728	0.0728	0.0000	180.2927	180.2927	0.0580	0.0000	181.5113
Total	**0.1619**	**1.7863**	**1.2848**	**2.0600e-003**	**0.4955**	**0.0791**	**0.5746**	**0.2000**	**0.0728**	**0.2728**	**0.0000**	**180.2927**	**180.2927**	**0.0580**	**0.0000**	**181.5113**

3.4 Grading - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1097	0.6789	1.9866	3.3000e-003	0.0752	0.0140	0.0891	0.0207	0.0129	0.0335	0.0000	279.8620	279.8620	2.2100e-003	0.0000	279.9083
Vendor	1.9800e-003	7.9500e-003	0.0379	2.0000e-005	0.3924	9.0000e-005	0.3925	0.0392	8.0000e-005	0.0393	0.0000	1.8849	1.8849	2.0000e-005	0.0000	1.8853
Worker	2.0600e-003	3.1300e-003	0.0269	9.0000e-005	7.3500e-003	5.0000e-005	7.4000e-003	1.9500e-003	4.0000e-005	2.0000e-003	0.0000	5.4440	5.4440	2.4000e-004	0.0000	5.4489
Total	**0.1137**	**0.6900**	**2.0514**	**3.4100e-003**	**0.4749**	**0.0141**	**0.4891**	**0.0618**	**0.0130**	**0.0748**	**0.0000**	**287.1908**	**287.1908**	**2.4700e-003**	**0.0000**	**287.2426**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2230	0.0000	0.2230	0.0900	0.0000	0.0900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0499	0.9828	1.1539	2.0600e-003		0.0416	0.0416		0.0416	0.0416	0.0000	180.2925	180.2925	0.0580	0.0000	181.5111
Total	**0.0499**	**0.9828**	**1.1539**	**2.0600e-003**	**0.2230**	**0.0416**	**0.2646**	**0.0900**	**0.0416**	**0.1316**	**0.0000**	**180.2925**	**180.2925**	**0.0580**	**0.0000**	**181.5111**

3.4 Grading - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1097	0.6789	1.9866	3.3000e-003	0.0752	0.0140	0.0891	0.0207	0.0129	0.0335	0.0000	279.8620	279.8620	2.2100e-003	0.0000	279.9083
Vendor	1.9800e-003	7.9500e-003	0.0379	2.0000e-005	0.3924	9.0000e-005	0.3925	0.0392	8.0000e-005	0.0393	0.0000	1.8849	1.8849	2.0000e-005	0.0000	1.8853
Worker	2.0600e-003	3.1300e-003	0.0269	9.0000e-005	7.3500e-003	5.0000e-005	7.4000e-003	1.9500e-003	4.0000e-005	2.0000e-003	0.0000	5.4440	5.4440	2.4000e-004	0.0000	5.4489
Total	**0.1137**	**0.6900**	**2.0514**	**3.4100e-003**	**0.4749**	**0.0141**	**0.4891**	**0.0618**	**0.0130**	**0.0748**	**0.0000**	**287.1908**	**287.1908**	**2.4700e-003**	**0.0000**	**287.2426**

3.5 Storm Drains and Perimeter Road - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0133	0.1322	0.1196	1.8000e-004		7.4200e-003	7.4200e-003		6.9500e-003	6.9500e-003	0.0000	15.9213	15.9213	4.0300e-003	0.0000	16.0059
Total	**0.0133**	**0.1322**	**0.1196**	**1.8000e-004**		**7.4200e-003**	**7.4200e-003**		**6.9500e-003**	**6.9500e-003**	**0.0000**	**15.9213**	**15.9213**	**4.0300e-003**	**0.0000**	**16.0059**

3.5 Storm Drains and Perimeter Road - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.2400e-003	0.0123	0.0128	7.0000e-005	1.9700e-003	2.8000e-004	2.2600e-003	5.6000e-004	2.6000e-004	8.2000e-004	0.0000	5.6434	5.6434	4.0000e-005	0.0000	5.6441
Worker	2.7000e-004	4.1000e-004	3.5400e-003	1.0000e-005	9.7000e-004	1.0000e-005	9.7000e-004	2.6000e-004	1.0000e-005	2.6000e-004	0.0000	0.7159	0.7159	3.0000e-005	0.0000	0.7166
Total	**1.5100e-003**	**0.0127**	**0.0163**	**8.0000e-005**	**2.9400e-003**	**2.9000e-004**	**3.2300e-003**	**8.2000e-004**	**2.7000e-004**	**1.0800e-003**	**0.0000**	**6.3593**	**6.3593**	**7.0000e-005**	**0.0000**	**6.3607**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.3500e-003	0.1234	0.1226	1.8000e-004		7.3000e-003	7.3000e-003		6.9700e-003	6.9700e-003	0.0000	15.9212	15.9212	4.0300e-003	0.0000	16.0059
Total	**9.3500e-003**	**0.1234**	**0.1226**	**1.8000e-004**		**7.3000e-003**	**7.3000e-003**		**6.9700e-003**	**6.9700e-003**	**0.0000**	**15.9212**	**15.9212**	**4.0300e-003**	**0.0000**	**16.0059**

3.5 Storm Drains and Perimeter Road - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.2400e-003	0.0123	0.0128	7.0000e-005	1.9700e-003	2.8000e-004	2.2600e-003	5.6000e-004	2.6000e-004	8.2000e-004	0.0000	5.6434	5.6434	4.0000e-005	0.0000	5.6441
Worker	2.7000e-004	4.1000e-004	3.5400e-003	1.0000e-005	9.7000e-004	1.0000e-005	9.7000e-004	2.6000e-004	1.0000e-005	2.6000e-004	0.0000	0.7159	0.7159	3.0000e-005	0.0000	0.7166
Total	**1.5100e-003**	**0.0127**	**0.0163**	**8.0000e-005**	**2.9400e-003**	**2.9000e-004**	**3.2300e-003**	**8.2000e-004**	**2.7000e-004**	**1.0800e-003**	**0.0000**	**6.3593**	**6.3593**	**7.0000e-005**	**0.0000**	**6.3607**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Non-Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.356538	0.043621	0.189607	0.131867	0.068149	0.010014	0.015891	0.157538	0.002569	0.000253	0.016679	0.001277	0.005997

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	6.0000e-005	1.0000e-005	6.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1700e-003	1.1700e-003	0.0000	0.0000	1.2400e-003
Unmitigated	6.0000e-005	1.0000e-005	6.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1700e-003	1.1700e-003	0.0000	0.0000	1.2400e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	6.0000e-005	1.0000e-005	6.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1700e-003	1.1700e-003	0.0000	0.0000	1.2400e-003
Total	**6.0000e-005**	**1.0000e-005**	**6.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.1700e-003**	**1.1700e-003**	**0.0000**	**0.0000**	**1.2400e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	6.0000e-005	1.0000e-005	6.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	1.1700e-003	1.1700e-003	0.0000	0.0000	1.2400e-003
Total	**6.0000e-005**	**1.0000e-005**	**6.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**1.1700e-003**	**1.1700e-003**	**0.0000**	**0.0000**	**1.2400e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Edwards AFB Landfill Closure

Kern-Mojave Desert County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	65.50	Acre	65.50	0.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.7 **Precipitation Freq (Days)** 32

Climate Zone 7 **Operational Year** 2021

Utility Company Southern California Edison

CO2 Intensity (lb/MWhr) 630.89 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - No new structures (square footage) planned that would require architechtural coating.

Construction Phase - Tatal days as estimated by the civil engineer

Off-road Equipment - Values estimated as entered

Off-road Equipment - Estimates as entered

Off-road Equipment - Equiment amounts estimated by civil project engineer

Off-road Equipment - Values estimated by project civil engineer

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Construction Off-road Equipment Mitigation - Tier 3

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3

tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstEquipMitigation	Tier	No Change	Tier 3
tblConstructionPhase	NumDays	1,110.00	30.00
tblConstructionPhase	NumDays	70.00	10.00
tblConstructionPhase	NumDays	110.00	73.00
tblConstructionPhase	NumDays	40.00	7.00
tblConstructionPhase	PhaseEndDate	6/16/2020	6/15/2020
tblConstructionPhase	PhaseStartDate	5/6/2020	5/5/2020
tblGrading	AcresOfGrading	182.50	275.00
tblGrading	AcresOfGrading	0.00	33.00
tblGrading	MaterialImported	0.00	270,000.00
tblLandUse	LandUseSquareFeet	2,853,180.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	PhaseName		Site Preparation
tblOffRoadEquipment	PhaseName		Site Preparation
tblOffRoadEquipment	PhaseName		Storm Drains and Perimeter Road
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	PhaseName		Storm Drains and Perimeter Road
tblOffRoadEquipment	UsageHours	8.00	5.00
tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	7.50
tblOnRoadDust	VendorPercentPave	100.00	50.00
tblOnRoadDust	VendorPercentPave	100.00	50.00
tblOnRoadDust	VendorPercentPave	100.00	50.00
tblProjectCharacteristics	OperationalYear	2014	2021
tblTripsAndVMT	HaulingTripLength	20.00	10.00
tblTripsAndVMT	HaulingTripNumber	33,750.00	17,419.00
tblTripsAndVMT	VendorTripLength	7.30	2.00
tblTripsAndVMT	VendorTripLength	7.30	2.00
tblTripsAndVMT	VendorTripLength	7.30	2.00
tblTripsAndVMT	VendorTripLength	7.30	37.00
tblTripsAndVMT	VendorTripNumber	0.00	8.00
tblTripsAndVMT	VendorTripNumber	0.00	8.00

tblTripsAndVMT	VendorTripNumber	0.00	8.00
tblTripsAndVMT	VendorTripNumber	0.00	4.00
tblTripsAndVMT	WorkerTripNumber	0.00	8.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2020	8.1875	76.5210	83.4759	0.1673	28.9095	3.0684	30.9246	8.3598	2.8321	10.1737	0.0000	15,794.5026	15,794.5026	2.1272	0.0000	15,839.1733
Total	**8.1875**	**76.5210**	**83.4759**	**0.1673**	**28.9095**	**3.0684**	**30.9246**	**8.3598**	**2.8321**	**10.1737**	**0.0000**	**15,794.5026**	**15,794.5026**	**2.1272**	**0.0000**	**15,839.1733**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2020	4.8562	53.9183	80.0904	0.1673	20.3905	2.0325	22.4230	4.4216	1.9781	6.3060	0.0000	15,794.5026	15,794.5026	2.1272	0.0000	15,839.1733
Total	**4.8562**	**53.9183**	**80.0904**	**0.1673**	**20.3905**	**2.0325**	**22.4230**	**4.4216**	**1.9781**	**6.3060**	**0.0000**	**15,794.5026**	**15,794.5026**	**2.1272**	**0.0000**	**15,839.1733**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**40.69**	**29.54**	**4.06**	**0.00**	**29.47**	**33.76**	**27.49**	**47.11**	**30.15**	**38.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	6.3000e-004	6.0000e-005	6.7100e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005		0.0143	0.0143	4.0000e-005		0.0151
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**6.3000e-004**	**6.0000e-005**	**6.7100e-003**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**2.0000e-005**		**0.0143**	**0.0143**	**4.0000e-005**	**0.0000**	**0.0151**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	6.3000e-004	6.0000e-005	6.7100e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005		0.0143	0.0143	4.0000e-005		0.0151
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**6.3000e-004**	**6.0000e-005**	**6.7100e-003**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**2.0000e-005**		**0.0143**	**0.0143**	**4.0000e-005**	**0.0000**	**0.0151**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2020	1/14/2020	5	10	
2	Site Preparation	Site Preparation	1/15/2020	1/23/2020	5	7	
3	Grading	Grading	1/24/2020	5/5/2020	5	73	
4	Storm Drains and Perimeter Road	Building Construction	5/5/2020	6/15/2020	5	30	

Acres of Grading (Site Preparation Phase): 33

Acres of Grading (Grading Phase): 275

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	1	5.00	162	0.38
Demolition	Rubber Tired Dozers	1	5.00	255	0.40
Site Preparation	Off-Highway Tractors	1	8.00	122	0.44
Site Preparation	Off-Highway Trucks	1	8.00	400	0.38
Site Preparation	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Grading	Excavators	0	8.00	162	0.38
Grading	Graders	1	4.00	174	0.41
Grading	Plate Compactors	2	4.50	8	0.43
Grading	Rubber Tired Dozers	2	6.00	255	0.40
Grading	Scrapers	3	6.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	7.50	97	0.37
Storm Drains and Perimeter Road	Cranes	0	7.00	226	0.29
Storm Drains and Perimeter Road	Forklifts	0	8.00	89	0.20
Storm Drains and Perimeter Road	Generator Sets	0	8.00	84	0.74
Storm Drains and Perimeter Road	Other Construction Equipment	1	8.00	171	0.42
Storm Drains and Perimeter Road	Pumps	1	4.00	84	0.74
Storm Drains and Perimeter Road	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Storm Drains and Perimeter Road	Welders	0	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	3	8.00	8.00	85.00	10.80	2.00	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	4	10.00	8.00	0.00	10.80	2.00	20.00	LD_Mix	HDT_Mix	HHDT
Grading	10	25.00	8.00	17,419.00	10.80	2.00	10.00	LD_Mix	HDT_Mix	HHDT
Storm Drains and Perimeter Road	3	8.00	4.00	0.00	10.80	37.00	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Clean Paved Roads

3.2 Demolition - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					1.8674	0.0000	1.8674	0.2828	0.0000	0.2828			0.0000			0.0000
Off-Road	1.1767	11.1871	10.7406	0.0151		0.5644	0.5644		0.5351	0.5351		1,452.5702	1,452.5702	0.3157		1,459.1989
Total	**1.1767**	**11.1871**	**10.7406**	**0.0151**	**1.8674**	**0.5644**	**2.4317**	**0.2828**	**0.5351**	**0.8178**		**1,452.5702**	**1,452.5702**	**0.3157**		**1,459.1989**

3.2 Demolition - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1352	1.1030	1.5811	6.2600e-003	0.1490	0.0269	0.1759	0.0409	0.0248	0.0657		589.0428	589.0428	4.1900e-003		589.1308
Vendor	0.0462	0.2113	0.6959	6.2000e-004	11.7837	2.3200e-003	11.7860	1.1777	2.1300e-003	1.1799		57.5007	57.5007	5.6000e-004		57.5126
Worker	0.0215	0.0243	0.2653	8.3000e-004	0.0657	4.1000e-004	0.0661	0.0174	3.8000e-004	0.0178		57.8589	57.8589	2.2900e-003		57.9070
Total	**0.2028**	**1.3386**	**2.5423**	**7.7100e-003**	**11.9984**	**0.0297**	**12.0280**	**1.2360**	**0.0273**	**1.2633**		**704.4024**	**704.4024**	**7.0400e-003**		**704.5503**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.8403	0.0000	0.8403	0.1272	0.0000	0.1272			0.0000			0.0000
Off-Road	0.3415	7.0403	9.2927	0.0151		0.3752	0.3752		0.3752	0.3752	0.0000	1,452.5702	1,452.5702	0.3157		1,459.1989
Total	**0.3415**	**7.0403**	**9.2927**	**0.0151**	**0.8403**	**0.3752**	**1.2155**	**0.1272**	**0.3752**	**0.5024**	**0.0000**	**1,452.5702**	**1,452.5702**	**0.3157**		**1,459.1989**

3.2 Demolition - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1352	1.1030	1.5811	6.2600e-003	0.1490	0.0269	0.1759	0.0409	0.0248	0.0657		589.0428	589.0428	4.1900e-003		589.1308
Vendor	0.0462	0.2113	0.6959	6.2000e-004	11.7837	2.3200e-003	11.7860	1.1777	2.1300e-003	1.1799		57.5007	57.5007	5.6000e-004		57.5126
Worker	0.0215	0.0243	0.2653	8.3000e-004	0.0657	4.1000e-004	0.0661	0.0174	3.8000e-004	0.0178		57.8589	57.8589	2.2900e-003		57.9070
Total	**0.2028**	**1.3386**	**2.5423**	**7.7100e-003**	**11.9984**	**0.0297**	**12.0280**	**1.2360**	**0.0273**	**1.2633**		**704.4024**	**704.4024**	**7.0400e-003**		**704.5503**

3.3 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					17.0437	0.0000	17.0437	7.1603	0.0000	7.1603			0.0000			0.0000
Off-Road	2.8411	29.3233	22.7068	0.0356		1.2942	1.2942		1.1907	1.1907		3,446.1347	3,446.1347	1.1146		3,469.5402
Total	**2.8411**	**29.3233**	**22.7068**	**0.0356**	**17.0437**	**1.2942**	**18.3379**	**7.1603**	**1.1907**	**8.3510**		**3,446.1347**	**3,446.1347**	**1.1146**		**3,469.5402**

3.3 Site Preparation - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0462	0.2113	0.6959	6.2000e-004	11.7837	2.3200e-003	11.7860	1.1777	2.1300e-003	1.1799		57.5007	57.5007	5.6000e-004		57.5126
Worker	0.0268	0.0304	0.3316	1.0300e-003	0.0822	5.1000e-004	0.0827	0.0218	4.7000e-004	0.0223		72.3236	72.3236	2.8600e-003		72.3837
Total	**0.0731**	**0.2417**	**1.0275**	**1.6500e-003**	**11.8658**	**2.8300e-003**	**11.8686**	**1.1995**	**2.6000e-003**	**1.2021**		**129.8243**	**129.8243**	**3.4200e-003**		**129.8963**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					7.6697	0.0000	7.6697	3.2221	0.0000	3.2221			0.0000			0.0000
Off-Road	0.8671	16.7632	19.8278	0.0356		0.6586	0.6586		0.6586	0.6586	0.0000	3,446.1347	3,446.1347	1.1146		3,469.5402
Total	**0.8671**	**16.7632**	**19.8278**	**0.0356**	**7.6697**	**0.6586**	**8.3282**	**3.2221**	**0.6586**	**3.8807**	**0.0000**	**3,446.1347**	**3,446.1347**	**1.1146**		**3,469.5402**

3.3 Site Preparation - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0462	0.2113	0.6959	6.2000e-004	11.7837	2.3200e-003	11.7860	1.1777	2.1300e-003	1.1799		57.5007	57.5007	5.6000e-004		57.5126
Worker	0.0268	0.0304	0.3316	1.0300e-003	0.0822	5.1000e-004	0.0827	0.0218	4.7000e-004	0.0223		72.3236	72.3236	2.8600e-003		72.3837
Total	**0.0731**	**0.2417**	**1.0275**	**1.6500e-003**	**11.8658**	**2.8300e-003**	**11.8686**	**1.1995**	**2.6000e-003**	**1.2021**		**129.8243**	**129.8243**	**3.4200e-003**		**129.8963**

3.4 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.5740	0.0000	13.5740	5.4794	0.0000	5.4794			0.0000			0.0000
Off-Road	4.4355	48.9407	35.2005	0.0564		2.1683	2.1683		1.9957	1.9957		5,444.8947	5,444.8947	1.7525		5,481.6966
Total	**4.4355**	**48.9407**	**35.2005**	**0.0564**	**13.5740**	**2.1683**	**15.7424**	**5.4794**	**1.9957**	**7.4751**		**5,444.8947**	**5,444.8947**	**1.7525**		**5,481.6966**

3.4 Grading - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	2.6524	17.6813	37.8265	0.0903	2.0937	0.3822	2.4760	0.5746	0.3517	0.9262		8,468.4226	8,468.4226	0.0658		8,469.8050
Vendor	0.0462	0.2113	0.6959	6.2000e-004	11.7837	2.3200e-003	11.7860	1.1777	2.1300e-003	1.1799		57.5007	57.5007	5.6000e-004		57.5126
Worker	0.0671	0.0761	0.8290	2.5800e-003	0.2054	1.2800e-003	0.2067	0.0545	1.1800e-003	0.0557		180.8089	180.8089	7.1600e-003		180.9593
Total	**2.7657**	**17.9687**	**39.3514**	**0.0935**	**14.0828**	**0.3858**	**14.4686**	**1.8068**	**0.3550**	**2.1617**		**8,706.7322**	**8,706.7322**	**0.0736**		**8,708.2769**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.1083	0.0000	6.1083	2.4657	0.0000	2.4657			0.0000			0.0000
Off-Road	1.3669	26.9250	31.6135	0.0564		1.1409	1.1409		1.1409	1.1409	0.0000	5,444.8947	5,444.8947	1.7525		5,481.6966
Total	**1.3669**	**26.9250**	**31.6135**	**0.0564**	**6.1083**	**1.1409**	**7.2492**	**2.4657**	**1.1409**	**3.6066**	**0.0000**	**5,444.8947**	**5,444.8947**	**1.7525**		**5,481.6966**

3.4 Grading - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	2.6524	17.6813	37.8265	0.0903	2.0937	0.3822	2.4760	0.5746	0.3517	0.9262		8,468.4226	8,468.4226	0.0658		8,469.8050
Vendor	0.0462	0.2113	0.6959	6.2000e-004	11.7837	2.3200e-003	11.7860	1.1777	2.1300e-003	1.1799		57.5007	57.5007	5.6000e-004		57.5126
Worker	0.0671	0.0761	0.8290	2.5800e-003	0.2054	1.2800e-003	0.2067	0.0545	1.1800e-003	0.0557		180.8089	180.8089	7.1600e-003		180.9593
Total	**2.7657**	**17.9687**	**39.3514**	**0.0935**	**14.0828**	**0.3858**	**14.4686**	**1.8068**	**0.3550**	**2.1617**		**8,706.7322**	**8,706.7322**	**0.0736**		**8,708.2769**

3.5 Storm Drains and Perimeter Road - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.8861	8.8152	7.9741	0.0122		0.4949	0.4949		0.4636	0.4636		1,170.0124	1,170.0124	0.2963		1,176.2345
Total	**0.8861**	**8.8152**	**7.9741**	**0.0122**		**0.4949**	**0.4949**		**0.4636**	**0.4636**		**1,170.0124**	**1,170.0124**	**0.2963**		**1,176.2345**

3.5 Storm Drains and Perimeter Road - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0788	0.7721	0.6846	4.4200e-003	0.1337	0.0189	0.1526	0.0380	0.0174	0.0554		415.0044	415.0044	2.5700e-003		415.0583
Worker	0.0215	0.0243	0.2653	8.3000e-004	0.0657	4.1000e-004	0.0661	0.0174	3.8000e-004	0.0178		57.8589	57.8589	2.2900e-003		57.9070
Total	**0.1003**	**0.7965**	**0.9499**	**5.2500e-003**	**0.1994**	**0.0193**	**0.2188**	**0.0554**	**0.0178**	**0.0732**		**472.8632**	**472.8632**	**4.8600e-003**		**472.9653**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.6234	8.2282	8.1756	0.0122		0.4864	0.4864		0.4644	0.4644	0.0000	1,170.0124	1,170.0124	0.2963		1,176.2345
Total	**0.6234**	**8.2282**	**8.1756**	**0.0122**		**0.4864**	**0.4864**		**0.4644**	**0.4644**	**0.0000**	**1,170.0124**	**1,170.0124**	**0.2963**		**1,176.2345**

3.5 Storm Drains and Perimeter Road - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0788	0.7721	0.6846	4.4200e-003	0.1337	0.0189	0.1526	0.0380	0.0174	0.0554		415.0044	415.0044	2.5700e-003		415.0583
Worker	0.0215	0.0243	0.2653	8.3000e-004	0.0657	4.1000e-004	0.0661	0.0174	3.8000e-004	0.0178		57.8589	57.8589	2.2900e-003		57.9070
Total	**0.1003**	**0.7965**	**0.9499**	**5.2500e-003**	**0.1994**	**0.0193**	**0.2188**	**0.0554**	**0.0178**	**0.0732**		**472.8632**	**472.8632**	**4.8600e-003**		**472.9653**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Non-Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.356538	0.043621	0.189607	0.131867	0.068149	0.010014	0.015891	0.157538	0.002569	0.000253	0.016679	0.001277	0.005997

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	6.3000e-004	6.0000e-005	6.7100e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005		0.0143	0.0143	4.0000e-005		0.0151
Unmitigated	6.3000e-004	6.0000e-005	6.7100e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005		0.0143	0.0143	4.0000e-005		0.0151

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	6.3000e-004	6.0000e-005	6.7100e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005		0.0143	0.0143	4.0000e-005		0.0151
Total	**6.3000e-004**	**6.0000e-005**	**6.7100e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**		**0.0143**	**0.0143**	**4.0000e-005**		**0.0151**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	6.3000e-004	6.0000e-005	6.7100e-003	0.0000		2.0000e-005	2.0000e-005		2.0000e-005	2.0000e-005		0.0143	0.0143	4.0000e-005		0.0151
Total	**6.3000e-004**	**6.0000e-005**	**6.7100e-003**	**0.0000**		**2.0000e-005**	**2.0000e-005**		**2.0000e-005**	**2.0000e-005**		**0.0143**	**0.0143**	**4.0000e-005**		**0.0151**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

APPENDIX B – 2

Alternative 4: Vertical Expansion Calculations

Edwards AFB Landfill Closure

Kern-Mojave Desert County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	65.50	Acre	65.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.7	**Precipitation Freq (Days)**	32
Climate Zone	7			**Operational Year**	2021
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	630.89	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

2.0 Waste Detail

2.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	883.4167	52.2084	0.0000	1,979.7937
Unmitigated	883.4167	52.2084	0.0000	1,979.7937

3.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
Rubber Tired Dozers	1	6.00	260	255	0.40	Diesel

UnMitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	tons/yr										MT/yr					
Rubber Tired Dozers	0.0853	0.8807	0.7005	8.6000e-004		0.0402	0.0402		0.0370	0.0370	0.0000	75.3208	75.3208	0.0244	0.0000	75.8324
Total	**0.0853**	**0.8807**	**0.7005**	**8.6000e-004**		**0.0402**	**0.0402**		**0.0370**	**0.0370**	**0.0000**	**75.3208**	**75.3208**	**0.0244**	**0.0000**	**75.8324**

Edwards AFB Landfill Closure

Kern-Mojave Desert County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	65.50	Acre	65.50	0.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.7 **Precipitation Freq (Days)** 32

Climate Zone 7 **Operational Year** 2021

Utility Company Southern California Edison

CO2 Intensity (lb/MWhr) 630.89 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

2.0 Waste Detail

2.1 Mitigation Measures Waste

3.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
Rubber Tired Dozers	1	6.00	260	255	0.40	Diesel

UnMitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	lb/day										lb/day					
Rubber Tired Dozers	0.6564	6.7749	5.3883	6.5900e-003		0.3094	0.3094		0.2847	0.2847		638.6693	638.6693	0.2066		643.0070
Total	**0.6564**	**6.7749**	**5.3883**	**6.5900e-003**		**0.3094**	**0.3094**		**0.2847**	**0.2847**		**638.6693**	**638.6693**	**0.2066**		**643.0070**

APPENDIX C – Relevant Biological Opinions

APPENDIX C – 1

Biological Opinion for Expansion and Upgrade of the Main Base Landfill (1992)

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
SOUTHERN CALIFORNIA FIELD STATION
2730 Loker Avenue West
Carlsbad, California 92008

October 13, 1992

Colonel Vernon P. Saxon, Jr.
Vice Commander
AFFTC/CD
Edwards Air Force Base, CA 93523-5000

Subject: Biological Opinion for Expansion and Upgrade of the Main Base Landfill, Edwards Air Force Base, California (1-6-92-F-61)

Dear Colonel Saxon:

This biological opinion responds to your request for formal consultation with the Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act). Your request was dated August 21, 1992, and received by us on September 9, 1992. At issue are impacts resulting from proposed expansion and upgrade of the Main Base Landfill at Edwards Air Force Base, California, which may affect the desert tortoise (Gopherus agassizii), a Federally listed threatened species.

This biological opinion was prepared using information from the following sources: your August 21, 1992, request for consultation and accompanying documentation, informal consultation between our staffs, and our files.

Biological Opinion

It is the opinion of the Service that the proposed project is not likely to jeopardize the continued existence of the desert tortoise. Critical habitat has not been designated for the Mojave population of the desert tortoise in California. Therefore, no critical habitat will be affected by the proposed action.

Description of the Proposed Action

The proposed project would consist of an upgrade and expansion of the existing Main Base Landfill at Edwards Air Force Base. The landfill would be deepened up to 40 feet and expanded horizontally to include about 390 acres surrounding the existing operation (figure 1). Horizontal expansion would occur incrementally, and as needed over time. A baler, composting, and recycling operation would be constructed as part of this upgrade (Eisenbart 1991). Estimated life span of the landfill is at least 50 years (Mark Hagan, Edwards Air Force Base, pers. comm. 1992).

The project also proposes solid waste assessment tests at the existing landfill and the closed landfill in the expansion area (figure 1). The purpose of the tests is to determine if soil or groundwater contamination is

resulting from landfill activities and to further define aquifer characteristics. Initially, 8 groundwater wells will be drilled. If sampling from any of these wells indicates contamination, then at least 2 additional wells would be constructed. An adequate number of wells would be constructed to define the plume of contamination from the landfill into the groundwater. Although the exact number and location of wells would depend on the test results from the first 8 drill holes, most wells would be located within the expansion area (Mark Hagan, pers. comm. 1992).

Integral components of the landfill operation include retrieval by work crews of windblown litter that escapes the fenced, active landfill, and recontouring of drainages immediately adjacent to the landfill. Both activities would occur around the perimeter of the active landfill and expand outward as the landfill grows.

Edwards Air Force Base proposes the following measures to reduce impacts to the desert tortoise and its habitat:

1. A ten mile-per-hour speed limit will be implemented on approved access routes within and adjacent to the landfill.

2. The active portion of the landfill shall be fenced with chain-link. A berm shall be built along the base of the fence to discourage entry by desert tortoises.

3. Activities outside the fenced landfill, including recontouring of drainages, and construction and operation of solid waste assessment test wells, will be enclosed by desert tortoise exclusion fence, or a biological monitor shall be present on site during all activities which may result in injury to a desert tortoise.

4. Preconstruction surveys will be conducted 24 hours in advance of project activities that could impact desert tortoises. Should desert tortoises be found within project areas, they will be removed a short distance to a safe location.

5. Desert tortoise burrows which cannot be avoided during project activities shall be excavated using hand tools. Desert tortoises found in these burrows shall be removed a short distance to a safe location.

6. Desert tortoises will be handled only by qualified biologists, including qualified personnel from the Environmental Management Office at Edwards Air Force Base.

7. All landfill personnel, and others as appropriate, will receive a worker education briefing or brochure. This briefing/brochure will be given to landfill personnel on an annual basis. The education program will explain the requirements for protection of desert tortoises, the natural history of the desert tortoise, and penalties under the Act,for unauthorized take.

8. One mile of 3-strand barbed wire fence will be constructed along the base boundary of Complex One Charlie, which supports a significant desert tortoise population. This fence will tie into the existing barbed wire fence and provide further protection to desert tortoise habitat there.

9. Edwards Air Force Base will participate in a cooperative raven (Corvus corax) study with the Service and the Bureau of Land Management (Bureau). The purpose of the study will be to examine raven utilization of the Main Base Landfill and determine the density, distribution, and dispersal of ravens in and around the landfill.

10. Solid waste assessment drill sites will be placed immediately adjacent to existing vehicle ways.

11. Boundaries of project areas will be clearly marked with flagging or stakes.

Effects of the Proposed Action on the Listed Species

Species Account

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered. In a final rule dated April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened. The desert tortoise is a large, herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts. It also occurs in Sonora and Sinaloa, Mexico. The threatened Mojave population is found in California, Nevada, and north of the Colorado River in Arizona and southwestern Utah. In the California deserts, desert tortoises are typically active during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and after infrequent summer monsoons. Desert tortoises spend the remainder of the year in burrows, escaping the extreme weather conditions of the desert.

Further information on the distribution, biology, and ecology of the desert tortoise can be found in Burge (1978), Burge and Bradley (1976), Hovik and Hardenbrook (1989), Luckenbach (1982), Turner et al. (1984), and Weinstein et al. (1987).

Description of the Environment

The landfill expansion area falls primarily within the saltbush series of Mohave desertscrub (Turner 1982, Eisenbart 1991). The area immediately north of the active landfill is characterized by creosote (Larrea tridentata), but the majority of the site is dominated by allscale (Atriplex polycarpa). Scattered Joshua trees (Yucca brevifolia) are found throughout the area. A list of plant species documented in the expansion area is presented by Eisenbart (1991). The terrain of the area is a gentle, southwest sloping bajada.

Desert tortoise surveys of the proposed landfill expansion area were conducted in April and May of 1991. A 100% survey coverage was attained by walking parallel and adjacent 10-meter wide transects throughout most of the expansion area. A 30-meter buffer zone around the expansion area was also surveyed. Some areas within the expansion zone were not surveyed, including the old landfill and an associated fenced maintenance yard, and the bladed area and borrow pit to the south of the active landfill. These areas are all heavily disturbed and considered non-habitat for the desert tortoise. All areas which potentially supported desert tortoises were surveyed (Eisenbart 1991).

About 269 acres were surveyed for desert tortoises. Nine corrected sign, including desert tortoise burrows, scat, and carcasses were found during the surveys; most sign was found north or west of the active landfill. No desert tortoises were observed in the expansion area; however, desert tortoises have been recently observed just outside the western boundary near the active landfill (Mark Hagan, pers. comm. 1992). The surveys indicate a very low density of desert tortoises. Eisenbart (1992) believed the northwest corner of the expansion area had the greatest potential for supporting desert tortoises.

Analysis of the Impacts

An estimated 269 acres of low density desert tortoise habitat would be lost as a result of landfill expansion. This loss would be incremental and occur over the life span of the landfill, estimated to be at least 50 years. Habitat adjacent to the landfill may be degraded as windblown refuse and sand escapes or passes through the landfill fence, possibly affecting vegetation or plugging burrows. Additional habitat would be lost outside the expansion area due to recontouring of drainages, refuse cleanup, and construction or operation of solid waste assessment test wells. Habitat loss due to these latter three activities is not expected to exceed 10 acres.

Given the low density of desert tortoise in the area, it is unlikely that biological monitors or construction crews would encounter a desert tortoise in the project area. However, desert tortoises or their burrows could be crushed by construction equipment or project vehicles. Loss of animals or burrows due to crushing would be minimized by the presence of a biological monitor during construction.

Foreign objects such as windblown refuse are occasionally consumed by desert tortoises (Burge 1989). These objects could become lodged in the gastrointestinal tract, causing mortality. Materials such as string or rubber bands may also entangle a desert tortoise, resulting in injury or death.

Ravens are attracted to the landfill as a food source and are known predators of desert tortoises (Eisenbart 1991, Campbell 1983, Miller 1932). Because ravens may forage widely and the landfill may have increased the carrying capacity for ravens in the area, desert tortoise predation within several miles of the landfill may be elevated. Expansion of the landfill would maintain this attractive nuisance. Ravens are attracted to the active portion of the landfill where refuse is exposed. Because this active portion is

expected to merely change location, and not size, the proposed expansion is not likely to increase local raven populations or desert tortoise predation over current levels. Use of a baler, as proposed, may reduce the availability of garbage to ravens.

The Service believes the impacts described above will not jeopardize the continued existence of the desert tortoise. We present this conclusion for the following reasons:

1. The project description includes efforts to minimize take of desert tortoises and mitigate the direct and indirect impacts of the proposed action.

2. The area which would be disturbed by the project is limited in size, supports few desert tortoises, and its loss as desert tortoise habitat would not contribute to further fragmentation of desert tortoise populations.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project.

Due to the extent of the lands in this area of the Mojave Desert administered by either the Air Force or the Bureau, many of the actions which are reasonably expected to occur within the vicinity of the project site will be subject to section 7 consultations. Outside of Edwards Air Force Base, there are also considerable private lands, the use of which is regulated by local governments. The Service has contacted the Counties of San Bernardino, Kern, Riverside, and Los Angeles (and the incorporated areas within the desert) regarding the listing of the desert tortoise and its implications for activities authorized by local governments. Many cities within the range of the desert tortoise in San Bernardino and Los Angeles Counties have expressed interest in obtaining a section 10(a)(1)(B) permit from the Service. This permit would allow take of desert tortoises as long as that take is "incidental to, and not the purpose of carrying out otherwise lawful activities" (16 U.S.C. 1539). Regional planning efforts, such as the West Mojave Coordinated Management Plan, could serve as model habitat conservation plans for local governments. Cumulative impacts of future State and private projects will be addressed in regional plans, such as this, and in the section 10(a)(1)(B) permit process.

Incidental Take

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Under the terms of section

7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with this incidental take statement. Reasonable and prudent measures, as well as terms and conditions in this biological opinion are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

This biological opinion anticipates the following forms of take:

1) One desert tortoise in the form of direct mortality resulting from project construction.

2) Five desert tortoises through harassment caused by moving desert tortoises out of harm's way by the authorized biologist.

This biological opinion does not authorize any form of take not incidental to expansion of the Main Base Landfill at Edwards Air Force Base, which includes construction and operation of solid waste assessment test wells and recontouring of drainages outside of the expansion area.

If the incidental take authorized by this opinion is met, Edwards Air Force Base shall immediately notify the Service in writing. If the incidental take authorized by this opinion is exceeded, Edwards Air Force Base shall cease the activity resulting in the take and reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental take authorized by this biological opinion:

1. Worker education programs, defined construction areas, and well-defined operational procedures shall be implemented.

2. Restrictions on construction activities shall be imposed as necessary to minimize the take of desert tortoises.

3. The active portion of the landfill shall be fenced. All desert tortoises within the fenced area shall be relocated to nearby habitat outside the fence.

4. Monitoring by on-site qualified biologist(s) shall be conducted to avoid or minimize the take of desert tortoises and loss of desert tortoise habitat during construction in areas outside of the landfill fence and inside the fence prior to desert tortoise relocation.

5. Measures to reduce raven and other potential desert tortoise predator use of the project area shall be implemented.

Terms and Conditions

The following terms and conditions are established to implement the reasonable and prudent measures described above. Terms and conditions 1 through 10 are taken from the project description in Edwards Air Force Base's request for initiation, but contain slight modifications or added detail. Term and condition 11 resulted from informal consultation between our offices.

1. A ten mile per hour speed limit shall be implemented on approved access routes within and adjacent to the landfill.

2. The active portion of the landfill shall be enclosed by a 7-foot tall chain-link fence. A berm shall be built along the base of the fence to discourage entry by desert tortoises.

3. Activities outside the fenced landfill, including recontouring of drainages, and construction and operation of solid waste assessment test wells, shall be enclosed by desert tortoise exclusion fence, or a biological monitor shall be present on site during all activities which may result in injury to a desert tortoise. After all construction activities are complete and no hazards to desert tortoise remain, the desert tortoise exclusion fence shall be removed.

4. Preconstruction surveys covering 100% of the area to be impacted shall be conducted within the 24 hours preceding initiation of project activities which may affect desert tortoises. Should desert tortoises be found within project areas, they shall be relocated pursuant to terms and conditions 6, 16, and 17.

5. Occupied or potentially occupied desert tortoise burrows which cannot be avoided during project activities shall be excavated using hand tools. Desert tortoises found in these burrows shall be relocated pursuant to terms and conditions 6, 16, and 17.

6. Only persons authorized by the Service under the auspices of this biological opinion, including qualified personnel of the Environmental Management Office at Edwards Air Force Base, shall be permitted to handle any desert tortoises that may be found during the pre-construction and construction phases of this project. If biologists other than qualified Environmental Management personnel are assigned to handle desert tortoises, the Service shall be supplied with their names(s) and credentials at least 15 days prior to the onset of any construction activities for review and approval. All handling of desert tortoises shall be in accordance with protocol adopted by the Service (Arizona Game and Fish Department et al. 1991).

7. All landfill personnel, and others as appropriate, shall receive a worker education briefing or brochure. This briefing/brochure shall be given to landfill personnel on an annual basis. The education program shall explain the requirements for protection of desert tortoises, the natural history of the desert tortoise, and penalties under the Act for unauthorized take.

8. One mile of 3-strand barbed wire fence shall be constructed along the boundary of Complex One Charlie, which supports a significant desert tortoise population. This fence shall tie into the existing barbed wire fence and provide further protection to desert tortoise habitat there.

9. Edwards Air Force Base shall participate in a cooperative raven study with the Service and the Bureau of Land Management. The purpose of the study shall be to determine raven utilization of the Main Base Landfill and the density, distribution, and dispersal of common ravens in and around the landfill.

10. Boundaries of project areas shall be clearly marked with flagging or stakes.

11. Solid waste assessment drill sites shall be placed immediately adjacent to existing vehicle ways and shall avoid impacts to desert tortoises and their burrows.

12. At solid waste assessment test sites outside the active landfill fence, all hazards to desert tortoises, such as drill holes or trenches shall be filled, sealed, or removed before the desert tortoise exclusion fence is removed or the biological monitor leaves the site.

Mark H. 7/12/18

13. Prior to construction, an individual shall be designated as a field contact representative who shall have the authority to ensure compliance with protective stipulations for the desert tortoise and be responsible for coordination with the Service. Such designated representative shall have the authority to halt activities that are in violation of Service stipulations.

14. Desert tortoise exclusionary fence constructed around project sites outside the active landfill fence shall extend 18 inches above the ground and 12 inches below the surface of the ground. The fence shall be located to avoid all desert tortoise burrows; to the extent possible, burrows shall be located outside of the exclosure. Where burial of the fence is not possible, the lower 12 inches shall be folded outward and fastened to the ground so as to prevent desert tortoise entry. The fence shall be supported sufficiently to maintain its integrity. Fencing material shall consist of 1-inch mesh hardware cloth or similar material. No construction activities shall occur prior to tortoise-proof fencing unless a biological monitor is on-site to insure such activity would not endanger desert tortoises. A biological monitor shall also be on-site during fence construction.

15. Following fencing of the active landfill or of individual project sites, authorized biologists shall survey the entire enclosed area and relocate any desert tortoises found above ground or excavated by hand from burrows pursuant to terms and conditions 6, 16, and 17. All desert tortoise cover sites within the fence shall be examined for occupancy. Unoccupied cover sites and those from which desert tortoises are removed shall be collapsed to prevent further use. When fencing is complete, and the biological monitor has removed all desert tortoises from the fenced area, construction activities inside the fence may proceed without the presence of a biological monitor.

16. Desert tortoises which must be moved out of harm's way shall be relocated by a biologist authorized in accordance with term and condition 6. Desert tortoises shall be relocated at least 200 feet away from unfenced project sites or just outside fenced sites in the direction of undisturbed habitat. If the relocation occurs in the season of above-ground activity, the desert tortoise shall be placed in the mouth of a burrow of appropriate size or in the shade of a large shrub. If the relocation is not in the season of above-ground activity, desert tortoises shall be moved on a seasonably warm day and placed at the mouth of a burrow of appropriate size. If the desert tortoise does not enter the burrow, or a burrow is not available, an artificial burrow shall be constructed and the desert tortoise placed within it. Artificial burrows shall be at least 6 feet in length and of the same diameter, depth, and orientation as the one in which the desert tortoise was found or as appropriate for the size of the subject desert tortoise. Wood or plastic materials may be used to strengthen the tunnel and/or chamber of the burrow. In coordination with the Service, the biological monitor shall be allowed some judgement and discretion to ensure that survival of the desert tortoise is likely.

17. Each desert tortoise requiring relocation found within 3 hours of nightfall or when ambient air temperatures exceed 90 degrees Fahrenheit shall be placed in a clean disposable cardboard box and held overnight in a cool location. The box shall be covered and kept in possession of an authorized biologist for release of each desert tortoise the next morning. Cardboard boxes used to hold desert tortoises shall be new, used once, and discarded. All materials which come into contact with desert tortoises shall be used only once and then properly discarded to minimize the possibility of disease transmission.

18. All construction workers shall strictly limit their activities and vehicles to construction areas within fenced or flagged project sites and to designated routes of travel.

19. The results of the raven study described in term and condition 9 shall be used by Edwards Air Force Base to define operational procedures and areas of the landfill which attract ravens. Edwards Air Force Base shall work with the Service to reduce raven use of the landfill through changes in landfill management.

20. In order to prevent ravens from seeking out desert tortoises as an alternate food resource, closure of the landfill or changes in operation which cause significant reductions in raven use shall occur during seasons when desert tortoises are inactive.

21. A report shall be prepared and delivered to the Service's Ventura Office in October 1993, documenting the effectiveness of these terms and conditions and the number of desert tortoises excavated from burrows or moved from construction sites. The report shall make recommendations for modifying or refining these terms and conditions to enhance desert tortoise protection or to reduce needless hardship on the project proponent. The report shall also quantify the acreage of desert tortoise habitat lost, and present future

construction schedules for landfill expansion and other activities addressed in this biological opinion.

Disposition of Dead, Injured, or Sick Desert Tortoises

Upon locating dead, injured, or sick desert tortoises, initial notification must be made to the Service's Law Enforcement Office in Torrance, California at (310) 297-0062 within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph, and any other pertinent information. The notification shall be sent to the Service's Torrance Office with a copy to the Ventura Office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. If possible, the remains of intact desert tortoises shall be placed with educational or research institutions holding appropriate State and Federal permits. If such institutions are not available or the shell has been damaged, the information noted above shall be obtained and the carcass left in place. To avoid re-recording carcasses, marking remains in a manner non-toxic to other wildlife should be considered.

Arrangements regarding placement of potential museum specimens shall be made with the institution prior to disposition. Injured animals should be transported to a qualified veterinarian. Should any treated desert tortoises survive, the Service should be contacted regarding the final disposition of the animals.

Conservation Recommendations

In furtherance of the purposes of sections 2(c) and 7(a)(1) of the Act that mandate Federal agencies to utilize their authorities to carry out programs for the conservation of listed species, we recommend implementing the following actions:

1. The chain-link fence enclosing the active portion of the landfill should be equipped with 1-inch mesh hardware cloth extending 12 inches below the surface and 18 inches above the ground to exclude all desert tortoises. Where burial of the fence would not be possible, the lower 12 inches could be folded outward and fastened to the ground so as to prevent desert tortoise entry.

2. Edwards Air Force Base should enclose, in a manner which would exclude ravens, screening, inspection, and all other areas besides active cells where garbage may be exposed to ravens for any length of time.

3. Edwards Air Force Base should take appropriate action to reduce perching and, particularly nesting, of ravens on buildings, fences, sign posts, and telephone or power poles near the landfill by reducing the availability of nesting and perching sites.

The Service requests notification of the implementation of any conservation recommendations so we can be kept informed of actions that either minimize or avoid adverse effects, or that benefit listed species or their habitats.

Conclusion

This concludes formal consultation on the Main Base Landfill at Edwards Air Force Base. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is reached; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). We would appreciate notification of your final decision on this matter. Any questions or comments should be directed to Jim Rorabaugh of the Ventura Office at (805) 644-1766.

Sincerely,

Richard Zembal

for Jeffrey D. Opdycke
Field Supervisor

Enclosure

Literature Cited

Arizona Game and Fish Department, California State Resource Agencies, Nevada Department of Wildlife, Utah Division of Wildlife Resources, United States Department of Interior, Bureau of Land management, and Fish and Wildlife Service. 1991. Interim techniques handbook for collecting and analyzing data on desert tortoise populations and habitats. Unpublished report.

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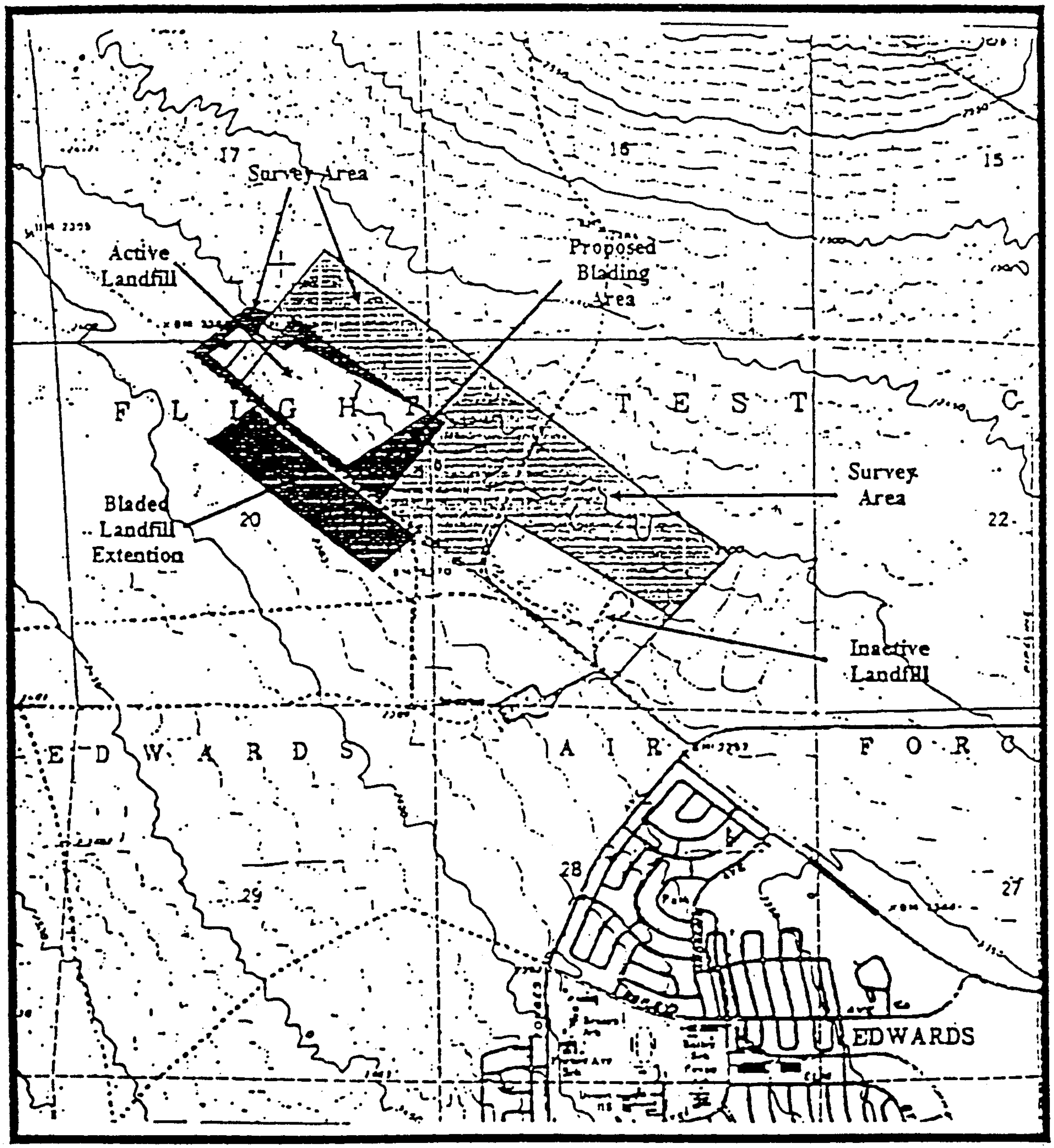


Portion of U.S.G.S. Quadrangle, Edwards, Calif., 7.5', 1973. Reduced by 10%.

Figure 1: Project area for the Edwards Air Force Base proposed landfill expansion. The proposed expansion area includes all shaded areas and the inactive landfill. Recontouring of drainages and construction of solid waste assessment test wells may extend outside the expansion area.

APPENDIX C – 2

Biological Opinion for Basewide Operation and Activities (2014)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN00-2014-F-0123

March 11, 2014

412 CE/CL
James E. Judkins
Base Civil Engineer
225 North Rosamond Boulevard
Edwards Air Force Base, California 93524

Subject: Biological Opinion for Operations and Activities at Edwards Air Force Base, California (8-8-14-F-14)

Dear Mr. Judkins:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion regarding the effects on the federally threatened desert tortoise (*Gopherus agassizii*) and its critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.), of all identified existing and future similar actions that are likely to occur on Edwards Air Force Base. This document also describes the criteria by which the U.S. Air Force will determine whether its actions are likely to adversely affect the desert tortoise or its critical habitat and our concurrence with actions that are undertaken within the framework of these criteria. We received your request for formal consultation on February 22, 2008.

This biological opinion is based on information which accompanied your request for consultation, conversations and correspondence with Edwards Air Force Base staff, and information contained in our files. A complete record of this consultation can be made available at the Ventura Fish and Wildlife Office.

Consultation History

Since 1990, the Air Force and Service have consulted formally on the effects of Air Force actions on the desert tortoise and its critical habitat 49 times; we have consulted informally on other actions. To date, we have completed consultations on a wide range of activities and uses, including recreational activities, construction and maintenance of infrastructure, remediation of contaminated sites, black box projects, and disposal of unstable rocket fuel. Prior to the initiation of formal consultation, staff from the Air Force and Service discussed the basic concepts of this base-wide consultation informally on several occasions.

On January 30, 2014, the Service (2014) provided the Air Force with a draft biological opinion. The Air Force (2014b) provided comments on the draft biological opinion on March 4, 2014; we have incorporated the Air Force's comments into this biological opinion, as appropriate.

ADMINISTRATION OF THE CONSULTATION

Future actions that may affect the desert tortoise or its critical habitat at Edwards Air Force Base will be evaluated in the following manner. The Environmental Management Office at Edwards Air Force Base will review all discretionary actions that the Air Force proposes on Edwards Air Force Base. Based on the nature of the activity, its potential to adversely affect desert tortoises or their critical habitat, and any measures that can be implemented to avoid or minimize the effect, the Air Force will determine whether the action will not affect, is not likely to adversely affect, or is likely to adversely affect the desert tortoise or its critical habitat.

The Air Force will maintain a record of all its activities that undergo this evaluation. For actions that do not affect or are not likely to adversely affect the desert tortoise or its critical habitat, the Air Force will include in its record:

1. The title of the action;
2. A description of the proposed action;
3. Location;
4. Size; and
5. The rationale that it used to reach its determination regarding effects to the desert tortoise or its critical habitat.

For actions that are likely to adversely affect the desert tortoise or its critical habitat, the Air Force will include in its record:

1. The title of the action;
2. A description of the proposed action;
3. Location;
4. Size;
5. The number of desert tortoises that are killed, injured, and moved from harm's way;
6. The amount of habitat disturbed or lost, with a notation as to whether the affected area was designated critical habitat;
7. A listed of authorized biologists who worked on actions covered by this consultation in the reporting year; and
8. A brief but comprehensive discussion of whether the protective measures were effective. If the measures were not effective, the Air Force will explain why the measures did not function as expected and recommendations for implementing more effective measures.

In past consultations with the Air Force, the Service has authorized biologists to implement protective measures and handle desert tortoises on a project-by-project basis. Upon completion of this consultation, the Air Force will not request such authorization on a project-by-project basis. From this point, any person that is approved by the Service to undertake the duties of an authorized biologist for actions proposed by the Air Force that are covered by this biological

opinion may also perform those duties on future actions. If the Air Force determines that an authorized biologist is not performing his or her duties in a satisfactory manner, the Air Force will notify the Service at the earliest possible time it makes this determination.

The Service and Air Force agree that some actions may be proposed in the future that may result in effects beyond the scope of those considered in this biological opinion. In the case of such actions, the Air Force and Service will discuss whether this biological opinion sufficiently considered effects to the desert tortoise and its critical habitat in light of the proposed action and whether re-initiation of formal consultation or initiation of a separate consultation is appropriate.

If staff from the Service and Air Force cannot agree on a course of action after discussions on this or other issues, any disagreement will be elevated to the Ventura Fish and Wildlife Office's Assistant Field Supervisor and the Air Force Civil Engineer Director and/or Environmental Management Division Chief for resolution. If further elevation is required, the Field Supervisor of the Ventura Fish and Wildlife Office and the Installation Commander of Edwards Air Force Base will be contacted to resolve the issue. Although the elevation of issues is likely to be an infrequent occurrence, the Air Force and Service consider this procedure to be a useful tool to maintain efficient processes and a healthy working relationship between our agencies.

The Air Force will provide the Service with an annual report of the activities that it conducts under the auspices of this consultation. The annual report will include the information that the Air Force will maintain in its records for any activity it determined was likely to adversely affect the desert tortoise or its critical habitat, as described in this section. The annual report will be provided to the Service by January 31 of each year this biological opinion is in effect.

The annual report will also contain information on conservation activities that the Air Force undertook in the previous year. Such activities may include, but are not limited to, acquisition of land through the Readiness and Environmental Preparedness Initiative, results of research on desert tortoises conducted or funded by the Air Force, and the results of relevant research conducted under the Air Force's Small Business Initiative.

The Ventura Fish and Wildlife Office's Assistant Field Supervisor, the Air Force Civil Engineer Director and/or Environmental Management Division Chief, and appropriate staff will meet annually to review how this consultation is functioning and to discuss any potentially important events in the upcoming year. This meeting could be held in conjunction with the quarterly meeting of the Desert Managers Group that occurs nearest the time the annual report is due. If the Service and Air Force agree that such a meeting is unnecessary in any given year, the meeting may be cancelled.

Criteria for Use in Reaching Appropriate Determinations

The Air Force will use the following outline to determine the appropriate level of consultation required for each proposed action.

1) Projects in which any effects would occur outside of desert tortoise habitat would have no effect on the species; the Air Force will document its determinations in these situations for its own records but would not need to contact the Ventura Fish and Wildlife Office. If the Air Force requires technical assistance from the Service to determine if suitable habitat for desert tortoises would be affected, it should contact us by phone or electronic mail.

2) If the following criteria are met, a determination of not likely to adversely affect the desert tortoise would be appropriate:

   a) The project is within habitat of the desert tortoise;

   b) Desert tortoise habitat is present, but degraded or disturbed, in the project area. For the purposes of this consultation, the Air Force and Service consider degraded habitat to be that habitat which has been affected by previous activities. Degraded habitat will generally exhibit a lower diversity and density of native shrubs and disrupted substrates than undisturbed habitat. The Air Force and Service may consider certain washes to be disturbed habitat; the fundamental guidance in such areas is that the evidence of the maintenance activity would no longer be visible after an event where water flows in the wash. The loss or disturbance of a minor amount of undisturbed habitat may also be considered as being not likely to adversely affect the species, when considered with regard to its distribution in the action area; and

   c) Neither desert tortoises nor their diagnostic sign are observed during surveys or a habitat assessment.

   In cases where a determination is not entirely clear from a verbal description, the Air Force will provide the Service with a photograph (aerial or otherwise, as appropriate) of the project site to assist in its determination.

3) If the following criteria are met, a determination of not likely to adversely affect critical habitat for the desert tortoise would be appropriate:

   a) The project is within designated critical habitat, but the primary constituent elements of desert tortoise critical habitat are not present;

   b) The primary constituent elements would not be affected by the proposed project; or

   c) Effects to the primary constituent elements would be so minor that they are not substantially measurable when considered within the context of the critical habitat unit. Such effects may occur, for example, when a narrow strip of land supporting the primary constituent elements of critical habitat at the edge of an existing road may be affected by an action.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Air Force requested consultation on a variety of mission support actions, including recurring and predicted new projects and future unknown projects. For this biological opinion, we worked with the Air Force to assess the threats to desert tortoises and their critical habitat associated with each type of proposed activity. Future actions under the control of the Air Force are expected to cause impacts that are similar to those discussed in the biological evaluation. The following table lists the Air Force's activities and notes the general manner by which the activity would affect the desert tortoise and its critical habitat (e.g., ground disturbance, use of roads, etc.). We will then consider more specifically the nature of these effects on the desert tortoise and its critical habitat and the measures that the Air Force has proposed to avoid, reduce, or minimize these effects. The biological evaluation contains a more detailed description of its proposed activities (Air Force 2008a).

Table 1 - Threats and Associated Activities of Proposed Actioin

		Driving off-road	Driving on road	Ground Disturbance	Explosions (potential for fire)	Non-native Plants	Common Ravens	Moving desert tortoise from harm	Personnel on Foot	Habitat Conversion
Range Flight Operations	Desert tortoise	N	Y	Y	Y	N	N	N	N	N
	Critical Habitat	N	Y	Y	Y	N	N	N	N	N
Airfield Flight Operations	Desert tortoise	N	N	N	N	N	N	N	N	N
	Critical Habitat					N/A				
Range Ground Operations	Desert tortoise	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Critical Habitat	Y	Y	Y	Y	Y	Y	Y	Y	Y
Directed Energy Operations	Desert tortoise	N	Y	N	Y	N	N	N	Y	N
	Critical Habitat	N	Y	N	Y	N	N	N	Y	N
Ordnance Expenditures	Desert tortoise	Y	Y	Y	y	N	N	Y	Y	N
	Critical Habitat	Y	Y	Y	Y	N	N	Y	Y	N
Energetic Material Expenditures	Desert tortoise	N	Y	N	y	N	N	Y	Y	N
	Critical Habitat	N	Y	N	Y	N	N	Y	Y	N
Native American Uses	Desert tortoise	N	Y	N	N	N	N	N	N	N
	Critical Habitat	N	Y	N	N	N	N	N	N	N
Research and Education	Desert tortoise	N	Y	N	N	N	N	Y	Y	N
	Critical Habitat	N	Y	N	N	N	N	Y	Y	N
Recreation	Desert tortoise	Y	Y	N	N	N	N	Y	Y	N
	Critical Habitat					N/A				
Feral Grazing Management	Desert tortoise	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Critical Habitat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Monitoring	Desert tortoise	Y	N	Y	N	N	Y	Y	Y	Y
	Critical Habitat	Y	N	Y	N	N	Y	Y	Y	Y
Inventories/Surveys	Desert tortoise	Y	N	Y	N	Y	Y	N	Y	N
	Critical Habitat	Y	N	Y	N	Y	Y	N	Y	N
Utility Maintenance	Desert tortoise	Y	Y	Y	Y	N	N	Y	Y	N
	Critical Habitat	Y	Y	Y	Y	N	N	Y	Y	Y
Fire Management	Desert tortoise	Y	Y	Y	N	N	N	Y	Y	N
	Critical Habitat	Y	Y	Y	N	N	N	Y	Y	Y
Future Development	Desert tortoise	Y	Y	Y	N	Y	Y	Y	Y	Y
	Critical Habitat	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y = Associated activity may affect the desert tortoise or its critical habitat in this manner. (Activities would affect critical habitat and habitat not designated as critical in the same basic manner; however, we do not consider effects to non-critical habitat in assessing whether a proposed action is likely to destroy or adversely modify critical habitat.)

N = Associated activity does not affect the desert tortoise or its critical habitat.

N/A = Associated activity does not occur in area of concern (desert tortoise habitat or critical habitat).

The Air Force anticipates that it may need 20,000 acres for future development of solar facilities, infrastructure, and mission activities and operations. The Air Force estimates that up to 5,000 acres of new disturbance may occur within critical habitat and 15,000 acres may occur outside of critical habitat. The Air Force would manage desert tortoises during the course of future development by following its integrated natural resources management plan.

The construction and operation of the Oro Verde Solar Project would occur within the boundaries of Edwards Air Force Base; this solar plant would require an interconnecting power line (gen-tie line) to the Windhub Substation, which lies to the northwest of base. For this reason, the Air Force requested that the Service also consider the effects of the construction and operation of the gen-tie line on the desert tortoise in this biological opinion. (The gen-tie line would not affect critical habitat; the nearest critical habitat for the desert tortoise is approximately 20 miles to the east of the easternmost portion of the gen-tie line.) The method used to construct the gen-tie line would occur in a manner similar to how the Air Force (or service companies operating within the base) would maintain utilities, although the impacts of construction would be more intense than would occur during maintenance.

To ensure that its activities do not result in numerous injuries to or mortalities of desert tortoises, the Air Force has proposed a set of thresholds that, if reached, will prompt additional action on its part to protect desert tortoises (Reinke 2009, Mull 2013a). If a desert tortoise is injured or killed in a calendar year, the Air Force will retrain those individuals that were responsible for implementing the activity, determine how to avoid future injuries or mortalities, and implement appropriate measures to reduce the number of future injuries or mortalities. The Air Force will also determine the root cause of the activities that resulted in the injury or mortality, determine appropriate measures to reduce, to the maximum extent possible, future injury or mortality, and obtain the Service's concurrence on implementation of the measures. Finally, the Air Force has proposed to re-initiate formal consultation if five desert tortoises are killed or injured in a calendar year.

The Air Force has also proposed to re-initiate formal consultation if the amount of desert tortoise habitat disturbed by its activities reaches 15,000 acres in the portion of Edwards Air Force Base that is outside of the boundaries of critical habitat. For the portion of the base within the boundaries of critical habitat, the Air Force has proposed to re-initiate formal consultation if the amount of desert tortoise habitat disturbed by its activities reaches 5,000 acres. The Air Force has been restoring lands disturbed by its activities so that these areas can support their ecological functions; the Air Force has also proposed to evaluate the effectiveness of its restoration activities and to subtract the acreage of restored habitat from the acreage of disturbed habitat as it monitors the activities it conducts under the auspices of this consultation. For example, if, in any given year, the Air Force disturbs 10 acres during its activities and restores 3 acres, the cumulative loss of habitat for the year would be 7 acres. For the purposes of tracking whether re-initiation is required, the Air Force will track the amount of habitat disturbed and restored upon completion of this biological opinion. Previously disturbed areas are not considered to be desert tortoise habitat for the purpose of tracking habitat loss; for example, any disturbance within the bed of an unpaved road would not be considered disturbance of desert tortoise habitat

because the biological and physical attributes of habitat are generally absent from such disturbed areas.

Adaptive Management Strategy

The Air Force has proposed three primary goals for its adaptive management strategy: 1) ensure that mission-related activities are conducted in compliance with Federal and State natural resource and other environmental legislation; 2) assess and monitor populations of listed, proposed, and sensitive species and general habitat conditions over time; and 3) ensure the long-term viability of desert tortoise populations within the Fremont-Kramer Desert Wildlife Management Area, while fully supporting the military mission at Edwards Air Force Base (Air Force 2008a). These goals apply to the annual and 5-year revisions of Edwards Air Force Base's integrated natural resources management plans.

Protective Measures

The Air Force has implemented a set of standardized minimization measures derived from numerous biological opinions to protect desert tortoises and conserve their habitat. These measures are applied selectively through the National Environmental Policy Act process via the Air Force Environmental Impact Analysis Process for each ground-disturbing action. The Air Force will continue implementing these minimization measures in the future as new types of projects occur in new areas that are expected to have similar impacts from mission activities.

a. Desert tortoises will be handled in full accordance with all applicable provisions and regulations of the Endangered Species Act. The phrases "authorized biologist" and "desert tortoise monitor", as used in this section are taken from the most up-to-date Service guidance (Service 2010a) and defined as follows:

    1. Authorized biologists must have thorough and current knowledge of desert tortoise behavior, natural history, ecology, and physiology, and demonstrate substantial field experience and training to safely and successfully conduct their required duties. Authorized biologists are approved to monitor project activities within desert tortoise habitat and are responsible for locating desert tortoises and their sign (i.e., conduct clearance surveys). Authorized biologists must ensure proper implementation of protective measures, and make certain that the effects of the project on the desert tortoise and its habitat are minimized in accordance with a biological opinion or incidental take permit. All incidents of noncompliance in accordance with the biological opinion or permit must be recorded and reported.

    2. Desert tortoise monitors will be approved by the authorized biologist to monitor project activities within desert tortoise habitat, ensure proper implementation of protective measures, and record and report desert tortoise and sign observations in accordance with approved protocol. They will report incidents of noncompliance in accordance with a biological opinion or permit, move desert tortoises from harm's way when desert tortoises enter project sites and place these animals in "safe areas"

pre-selected by authorized biologists or maintain the desert tortoises in their immediate possession until an authorized biologist assumes care of the animal. Desert tortoise monitors assist authorized biologists during surveys and serve as "apprentices" to acquire experience. Monitors should not conduct clearance surveys or other specialized duties of the authorized biologist unless directly supervised by an authorized biologist; "directly supervised" means the authorized biologist has direct voice and sight contact with the monitor. The desert tortoise monitor may directly supervise other personnel to assist with surveying for desert tortoises when deemed necessary.

3. None of the proposed measures will prohibit any individual from handling a desert tortoise when necessary to protect the safety or health of the animal.

b. Authorized biologists are the only individuals approved to handle desert tortoises on base. The Service's standardized form will be used for individuals to work on specific projects to verify the capabilities and experience of the potential desert tortoise biologist.

c. All base personnel (including contractors, civilian, and military employees) will be provided, at a minimum, a description of the desert tortoise, its status, and measures to minimize impacts. The material may also include the use of a multimedia presentation (videotape and printed material).

d. To the maximum extent practicable, activities will be sited to avoid effects to desert tortoises and their habitat.

e. Personnel will immediately report sightings of desert tortoises or sign found in the project area to the authorized biologist, desert tortoise monitor, or the Environmental Management Office.

f. Pre-activity surveys will be conducted, where deemed necessary, in project areas prior to ground-disturbing activities.

g. The project work areas will be fenced, flagged, or marked to define the limit of project activities.

h. Vehicles will generally remain on previously established roads and within staging areas and follow flagged off road routes that have been surveyed or cleared of desert tortoises. When driving off road, operators will minimize disturbance to vegetation and not exceed 10 miles per hour. All personnel will inspect under vehicles for desert tortoises prior to operating them in desert tortoise habitat.

i. Open excavations will be checked three times a day and authorized personnel will remove any trapped animals. Open excavations will be covered, backfilled, or fenced at the end of each workday. At the ends of a ditch or trench, a 3:1 slope will be created to allow wildlife to exit should they become trapped in the ditch or trench. All open excavations that are left unattended will be fenced, unless other methods of excluding desert tortoises are employed.

j. Any pipes left or stored on the ground in the project area will be capped on the ends to prevent entry by desert tortoises or other wildlife.

k. Parking and staging areas will be restricted to previously disturbed areas as much as possible.

l. Acres of disturbance will be tracked to provide a basis for possible future re-vegetation and restoration efforts.

m. All trash and food items will be disposed of in common raven-proof containers, and regularly removed from project sites to reduce attraction of common ravens.

n. Project activities between dusk and dawn will be confined to areas free of vegetation and cleared of desert tortoises by authorized personnel.

o. An annual report will be submitted to the Service summarizing any injury, mortality, or handling of desert tortoises, disturbance of critical habitat, and habitat restoration.

Other Measures Implemented for Specific Activities

The following minimization measures are being implemented to aid overall management of the desert tortoise on base.

Motorized Recreation Areas

a. Signs will be maintained along the designated off-road vehicle area boundaries.

b. Bulletin boards displaying up-to-date rules and safety information will be placed at the main access areas at each off-road vehicle area.

c. Law Enforcement personnel will patrol the areas to ensure that riders remain within the boundaries and use existing trails.

d. All operators of motor vehicles will take desert tortoise awareness training and carry proof of training when riding.

e. Environmental Management will monitor and record habitat disturbance. Solutions to problems that may develop will be suggested by the off-road vehicle area subcommittee and implemented by the Air Force.

Non-motorized Recreation Areas

a. Signs, notices, and other media will be used to inform personnel that use of off-road vehicle area 3 requires desert tortoise awareness training.

b. Desert tortoises crossing trails will not be moved; bikers and joggers will wait until the desert tortoise moves off the trail.

c. Activities will occur on established trails.

d. Pets not on leashes will not be allowed in the non-motorized recreation area.

Road Construction and Maintenance

a. All drainage recontouring will be limited to the greatest extent possible to reduce habitat fragmentation, where practicable.

b. Maintenance of drainage ditches will not be altered to change the direction of stormwater runoff from existing conditions to avoid potential flooding of desert tortoise burrows downslope of maintenance activities to the greatest extent possible.

c. Herbicide applicators will be instructed to watch for desert tortoises on road shoulders and to take precautions, as necessary, to ensure that no desert tortoises are sprayed.

d. Fugitive dust generated during construction will be controlled with water; the amount of water used will be restricted to the minimum amount required to maintain air quality standards.

e. Water tanks and trucks will be maintained in good working order and free of leaks so common ravens will not be attracted to standing water.

f. Installation of fencing along roadways will be implemented in areas deemed hazardous to desert tortoises to prevent injury or mortality.

Utilities

a. Aboveground gas lines will be placed at least 18 inches aboveground when they traverse desert tortoise habitat.

b. If, at any time after installation, the height of the gas pipes above the ground has been reduced to less than 18 inches, the pipelines will either be raised or the materials causing the reduction will be removed.

c. Lands above underground utilities will be re-vegetated unless a road needs to be constructed and maintained for access and maintenance activities.

d. Roads needed for utility maintenance will be concentrated in previously established corridors when possible.

e. Underground utilities will be located adjacent to or within previously disturbed areas when possible.

Re-vegetation

a. Habitat restoration required under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended under the Superfund Amendments and Reauthorization Act of 1986 for mission related ground disturbance would include using techniques to control soil erosion that have been proven successful in the desert environment and will also include use of native plants and seeds in an attempt to mimic natural biodiversity.

b. Priority for re-vegetation will be given to desert tortoise critical habitat.

c. Restoration activities will be conducted in accordance with the re-vegetation plans prepared by Edwards Air Force Base (Air Force 1994; Air Force 2012) and any new scientifically proven methodology.

d. Monitoring success of efforts will be implemented for a longer period than the standard 5-year monitoring period due to slow recovery rates of re-vegetated areas in the desert.

Management of Common Ravens

The Air Force will implement protective measures to reduce the adverse effects associated with predation of desert tortoises by common ravens. In general, the Air Force proposes to manage common ravens by controlling the use of landfills and sewage ponds, designing facilities to discourage common raven use, minimizing or eliminating food and water subsidies, providing training to on-site personnel, monitoring the presence of common ravens and their use of subsidies, and studying common raven predation on juvenile tortoises. The biological evaluation (Air Force 2008a) and integrated natural resource management plan (Air Force 2008b) contain more detailed information on these management actions.

Relocation of Desert Tortoises

In the event that future development or activities would result in the clearing of a large area of suitable desert tortoise habitat, the Air Force would relocate desert tortoises from these sites to other habitat. The Air Force will monitor all translocated desert tortoises to determine the success of the relocation.

Monitoring of the Desert Tortoise Population

Since 1988, Environmental Management has conducted numerous surveys for desert tortoises. The Air Force monitors desert tortoise populations using data collected by researchers and consultants who conduct studies or monitor projects on base. The Air Force uses these data to update database files and various Geographic Information System databases and spreadsheets to facilitate effective management of desert tortoises on base. It will thoroughly analyze and evaluate existing data and provide an up-to-date status of the current estimated distribution,

abundance, and trends of the on-base population of desert tortoises. Currently, the density of the tortoise population on base is unknown.

Long-Term Monitoring of Ecological Trends

The protection, restoration, and conservation of desert habitat are an ongoing management process at Edwards Air Force Base. One key component of this process is the ability to check progress against established benchmarks and use this information to develop effective management strategies that are expected to change over time. As part of the habitat quality analysis studies initiated at Edwards Air Force Base in 1992, the Air Force established 60 long-term monitoring plots to determine baseline conditions of habitat quality and to monitor long-term trends of habitat quality and species diversity. Periodic vegetation and wildlife surveys provide the benchmarks to evaluate environmental change. Each restored area is analyzed in comparison to 3 or 4 study sites with similar habitat characteristics (Reinke 2013). Information obtained from the long-term study plots and natural restoration are also used to determine habitat stability and support the regional desert tortoise recovery effort and the goals and objectives of Edwards Air Force Base's integrated natural resources management plan (Air Force 2008b).

The primary purpose of the integrated natural resources management plan for Edwards Air Force Base is "to implement natural resource management practices that strive to maintain or enhance habitat quality of the installation's natural resources resulting in stabilizing and/or increasing the biodiversity of the desert environment" (Air Force 2008b). The Air Force intends to achieve this purpose through the goals identified in the integrated natural resources management plan, which include but are not limited to monitoring of natural resources, collection of data, management of invasive species, conservation of habitat, and increasing the environmental awareness of all base personnel. The integrated natural resources management plan calls for the meeting of these goals "... in concert with other base organizations, and their programs and plans while ensuring no net loss to the capability of the military mission' (Air Force 2008b).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 Code of Federal Regulations 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the range-wide condition of the desert tortoise, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the desert tortoise in the action area, the factors responsible for that

condition, and the relationship of the action area to the survival and recovery of the desert tortoise; (3) the Effects of the Action, which determine the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the desert tortoise; and (4) the Cumulative Effects, which evaluate the effects of future, non-federal activities in the action area on the desert tortoise.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the current status of the desert tortoise, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the desert tortoise in the wild.

Adverse Modification Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of the critical habitat of listed species. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 Code of Federal Regulations 402.02. Instead, we have relied on the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which describes the range-wide condition of designated critical habitat for the desert tortoise in terms of primary constituent elements, the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the Environmental Baseline, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the primary constituent elements and how that will influence the recovery role of the affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future non-federal activities in the action area on the primary constituent elements and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the critical habitat of the desert tortoise are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the primary constituent elements to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the desert tortoise.

STATUS OF THE DESERT TORTOISE AND CRITICAL HABITAT

Status of the Desert Tortoise

Section 4(c)(2) of the Act requires the Service to conduct a status review of each listed species at least once every five years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review); these reviews, at the time of their completion, provide the most up-to-date information on the range-wide status of the species. For this reason, we are appending the 5-year review of the status of the desert tortoise (Appendix 1; Service 2010b) to this biological opinion and are incorporating it by reference to provide most of the information needed for this section of the biological opinion. The following paragraphs provide a summary of the relevant information in the 5-year review.

In the 5-year review, the Service discusses the status of the desert tortoise as a single distinct population segment and provides information on the Federal Register notices that resulted in its listing and the designation of critical habitat. The Service also describes the desert tortoise's ecology, life history, spatial distribution, abundance, habitats, and the threats that led to its listing (i.e., the 5-factor analysis required by section 4(a)(1) of the Act). In the 5-year review, the Service concluded by recommending that the status of the desert tortoise as a threatened species be maintained.

With regard to the status of the desert tortoise as a distinct population segment, the Service concluded in the 5-year review that the recovery units recognized in the original and revised recovery plans (Service 1994a and 2011a, respectively) do not qualify as distinct population segments under the Service's distinct population segment policy (61 Federal Register 4722; February 7, 1996). We reached this conclusion because individuals of the listed taxon occupy habitat that is relatively continuously distributed, exhibit genetic differentiation that is consistent with isolation-by-distance in a continuous-distribution model of gene flow, and likely vary in behavioral and physiological characteristics across the area they occupy as a result of the transitional nature of, or environmental gradations between, the described subdivisions of the Mojave and Colorado deserts.

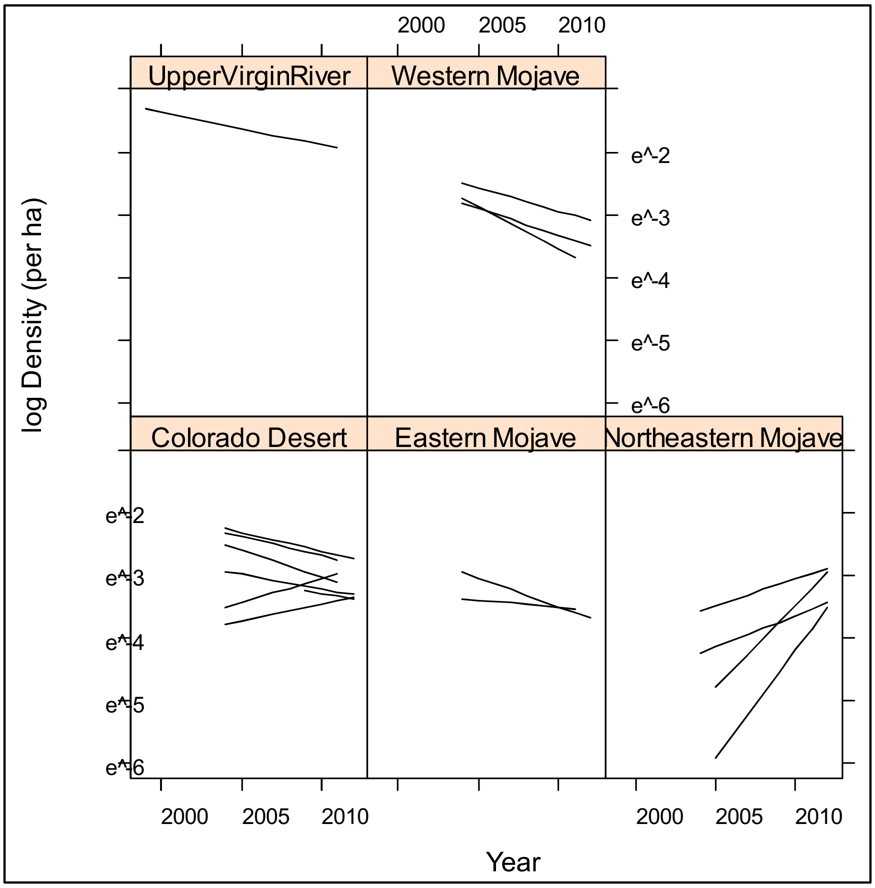
In the 5-year review, the Service summarizes information with regard to the desert tortoise's ecology and life history. Of key importance to assessing threats to the species and to developing and implementing a strategy for recovery is that desert tortoises are long lived, require up to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential. The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition. Predation seems to play an important role in clutch failure. Predation and environmental factors also affect the survival of hatchlings.

In the 5-year review, the Service also discusses various means by which researchers have attempted to determine the abundance of desert tortoises and the strengths and weaknesses of those methods. Due to differences in area covered and especially to the non-representative

nature of earlier sample sites, data gathered by the Service's current range-wide monitoring program cannot be reliably compared to information gathered through other means at this time.

The Service provides a summary table of the results of range-wide monitoring, initiated in 2001, in the 5-year review. This ongoing sampling effort is the first comprehensive attempt to determine the densities of desert tortoises across their range. Table 1 of the 5-year review provides a summary of data collected from 2001 through 2007; we summarize data from the 2008 through 2012 sampling efforts in subsequent reports (Service 2012a, 2012b, 2012c, 2012d).

The Service's Desert Tortoise Recovery Office (2014) used annual density estimates to compare a set of models that describe abundance patterns based on linear and quadratic response over time, spatial variation between desert tortoise conservation areas (e.g., national parks, desert wildlife management areas, the Desert Tortoise Natural Area, etc.) and recovery units, and survey team experience. The best model describing range-wide patterns in desert tortoise densities indicated different linear trends in different recovery units (see following figure); an effective training program precluded effects of surveyor experience or the lack thereof. In the original recovery plan for the desert tortoise, the Service (1994a) expected monitoring to detect increasing population trends of no more than 2 percent per year over a 25-year period. The Service has found much larger annual increases (greater than 19.7 percent) in the Northeastern Mojave Recovery Unit since 2004, with the rate of increase apparently resulting from increased survival of adults and subadults moving into the adult size class. The weight of evidence indicates that populations in the other 4 recovery units are declining: Upper Virgin River (-5.1 percent), Eastern Mojave (-5.8 percent), Western Mojave (-9.8 percent), and Colorado Desert (-2.4 percent; however, 2 desert tortoise conservation areas within this unit seem to be increasing).



Allison (2013) also evaluated changes in size distribution of desert tortoises since 2001. In the Western Mojave, Eastern Mojave, and Colorado Desert recovery units, the median size of large individuals has increased, indicating less recruitment of younger (therefore smaller) desert tortoises. In the Western Mojave and Colorado Desert recovery units, the relative number of smaller desert tortoises is about half what it was in 2001. Taken together, these trends suggest fewer small desert tortoises are reaching sexual maturity, which may be explained because they comprise a smaller proportion of the population or possibly because their survival rates are relatively lower than those of adults. Either possibility indicates that smaller size classes, like adults, are affected by ongoing threats; however, because most small desert tortoises die before reaching 180 millimeters in length, we do not know whether the reduced number of small animals has directly contributed to the observed declining trends in adults. For instance, a small increase in adult mortality would have a much larger effect on adult densities. None of these demographic rates have been measured in parallel with this study, so we cannot point to specific demographic rates that are associated with these overall population declines.

In the 5-year review, the Service provides a brief summary of habitat use by desert tortoises; more detailed information is available in the revised recovery plan (Service 2011a). In the absence of specific and recent information on the location of habitable areas of the Mojave Desert, especially at the outer edges of this area, the 5-year review also describes and relies heavily on a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River that incorporates environmental variables such as precipitation, geology,

heavily on a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River that incorporates environmental variables such as precipitation, geology, vegetation, and slope and is based on occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2005 range-wide monitoring surveys (Nussear et al. 2009). The model predicts the probability that desert tortoises will be present in any given location; calculations of the amount of desert tortoise habitat in the 5-year review and in this biological opinion use a threshold of 0.5 or greater predicted value for potential desert tortoise habitat. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

To begin integrating anthropogenic activities and the variable risk levels they bring to different parts of the Mojave and Colorado deserts, the Service completed an extensive review of the threats known to affect desert tortoises at the time of their listing and updated that information with more current findings in the 5-year review. The review follows the format of the five-factor analysis required by section 4(a)(1) of the Act. The Service described these threats as part of the process of its listing (55 Federal Register 12178; April 2, 1990), further discussed them in the original recovery plan (Service 1994a), and reviewed them again in the revised recovery plan (Service 2011a).

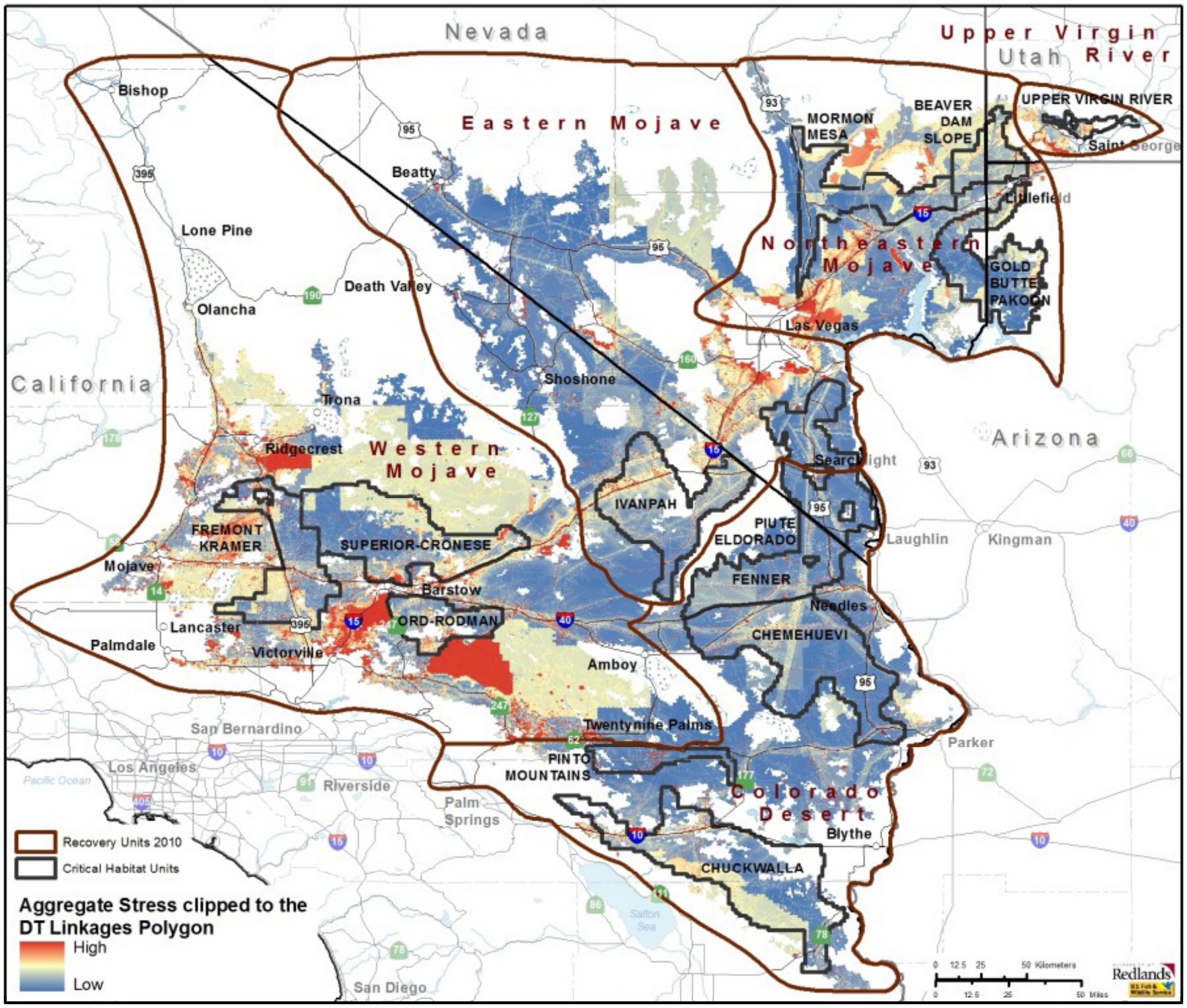
To understand better the relationship of threats to populations of desert tortoises and the most effective manner to implement recovery actions, the Desert Tortoise Recovery Office is developing a spatial decision support system that models the interrelationships of threats to desert tortoises and how those threats affect population change. The spatial decision support system describes the numerous threats that desert tortoises face, explains how these threats interact to affect individual animals and habitat, and how these effects in turn bring about changes in populations. For example, we have long known that the construction of a transmission line can result in the death of desert tortoises and loss of habitat. We have also known that common ravens, known predators of desert tortoises, use the transmission line's pylons for nesting, roosting, and perching and that the access routes associated with transmission lines provide a vector for the introduction and spread of invasive weeds and facilitate increased human access into an area. Increased human access can accelerate illegal collection and release of desert tortoises and their deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive plants (Service 2011a). Changes in the abundance of native plants because of invasive weeds can compromise the physiological health of desert tortoises, making them more vulnerable to drought, disease, and predation. The spatial decision support system allows us to map threats across the range of the desert tortoise and model the intensity of stresses that these multiple and combined threats place on desert tortoise populations.

The threats described in the listing rule and both recovery plans continue to affect the species. Indirect impacts to desert tortoise populations and habitat occur in accessible areas that interface with human activity. Most threats to the desert tortoise or its habitat are associated with human land uses; research since 1994 has clarified many mechanisms by which these threats act on desert tortoises. As stated earlier, increases in human access can accelerate illegal collection and

release of desert tortoises and deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive weeds.

Some of the most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects, and those that fragment and degrade habitats, such as proliferation of roads and highways, off-highway vehicle activity, and habitat invasion by non-native invasive plant species. However, we remain unable to quantify how threats affect desert tortoise populations. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy et al. 2004).

The following map depicts the 12 critical habitat units of the desert tortoise, linkages between conservation areas for the desert tortoise, and the aggregate stress that multiple, synergistic threats place on desert tortoise populations. Conservation areas include designated critical habitat, lands managed by the National Park Service, and other lands managed for the long-term conservation of the desert tortoise (e.g., the Desert Tortoise Natural Area in Kern County, California). The revised recovery plan (Service 2011a) recommended the linkages based on an analysis of least-cost pathways (i.e., areas with the highest potential to support desert tortoises) between conservation areas for the desert tortoise. This map illustrates that, across the range, desert tortoises in areas under the highest level of conservation management remain subject to numerous threats, stresses, and mortality sources.



Since the completion of the 5-year review, the Service has issued several biological opinions that affect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise primarily because they were located outside of critical habitat and desert wildlife management areas that contain most of the land base required for the recovery of the species. The proposed actions also included numerous measures intended to protect desert tortoise during the construction of the projects, such as translocation of affected individuals. In aggregate, these projects would result in an overall loss of approximately 37,503 acres of habitat of the desert tortoise. We also predicted that these projects would translocate or kill up to 1,732 desert tortoises; we concluded that most of the individuals in these totals would be juveniles. To date, 372 desert tortoises have been observed during construction of projects; most of these individuals were translocated from work areas, although some desert tortoises have been killed (see appendix 2). The mitigation required by the Bureau and California Energy Commission, the agencies permitting these facilities, will result in the acquisition of private land within critical habitat and desert wildlife management areas and funding for the implementation of various actions that are intended to promote the recovery of

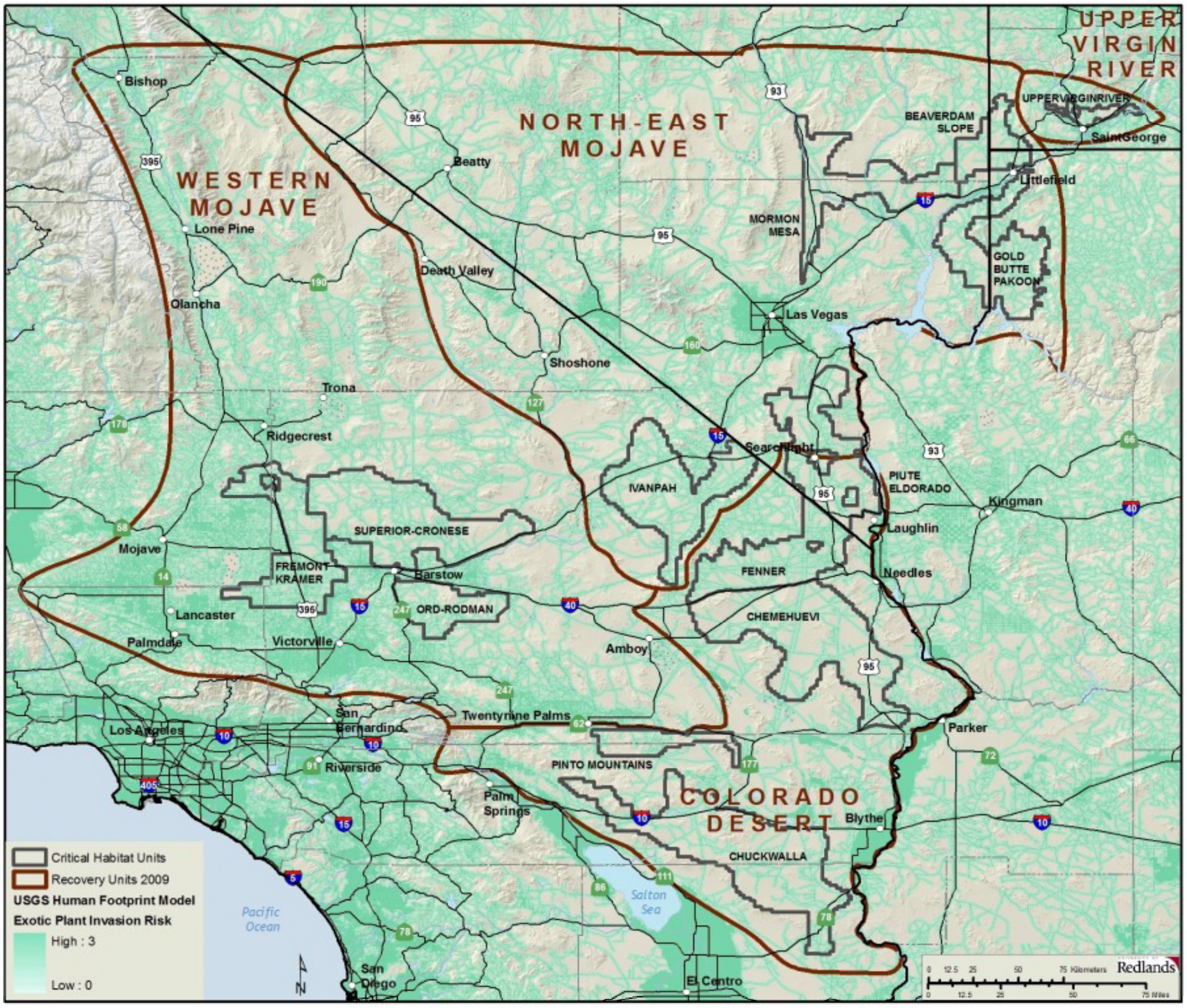
funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise. Although most of these mitigation measures are consistent with recommendations in the recovery plans for the desert tortoise and the Service continues to support their implementation, we cannot assess how desert tortoise populations will respond because of the long generation time of the species.

In addition to the biological opinions issued for solar development within the range of the desert tortoise, the Service (2012e) also issued a biological opinion to the Department of the Army for the use of additional training lands at Fort Irwin. As part of this proposed action, the Army removed approximately 650 desert tortoises from 18,197 acres of the southern area of Fort Irwin, which had been off-limits to training. The Army would also use an additional 48,629 acres that lie east of the former boundaries of Fort Irwin; much of this parcel is either too mountainous or too rocky and low in elevation to support numerous desert tortoises.

The Service also issued a biological opinion to the Marine Corps that considered the effects of the expansion of the Marine Corps Air Ground Combat Center at Twentynine Palms (Service 2012f). We concluded that the Marine Corps' proposed action, the use of approximately 167,971 acres for training, was not likely to jeopardize the continued existence of the desert tortoise. Most of the expansion area lies within the Johnson Valley Off-high Vehicle Management Area.

The incremental effect of the larger actions (i.e., solar development, the expansions of Fort Irwin, and the Marine Corps Air Ground Combat Center) on the desert tortoise is unlikely to be positive, despite the numerous conservation measures that have been (or will be) implemented as part of the actions. The acquisition of private lands as mitigation for most of these actions increases the level of protection afforded these lands; however, these acquisitions do not create new habitat and Federal, State, and privately managed lands remain subject to most of the threats and stresses we discussed previously in this section. Although land managers have been implementing measures to manage these threats, we have been unable, to date, to determine whether the measures have been successful, at least in part because of the low reproductive capacity of the desert tortoise. Therefore, the conversion of habitat into areas that are unsuitable for this species continues the trend of constricting the desert tortoise into a smaller portion of its range.

As the Service notes in the 5-year review (Service 2010b), "(t)he threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The vast majority of threats to the desert tortoise or its habitat are associated with human land uses." Oftedal's work (2002 in Service 2010b) suggests that invasive weeds may adversely affect the physiological health of desert tortoises. Current information indicates that invasive species likely affect a large portion of the desert tortoise's range (see following map). Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.



Global climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. For example, predictions for climate change within the range of the desert tortoise suggest more frequent and/or prolonged droughts with an increase of the annual mean temperature by 3.5 to 4.0 degrees Celsius. The greatest increases will likely occur in summer (June-July-August mean increase of as much as 5 degrees Celsius [Christensen et al. 2007 in Service 2010b]). Precipitation will likely decrease by 5 to 15 percent annually in the region with winter precipitation decreasing by up to 20 percent and summer precipitation increasing by up to 5 percent. Because germination of the desert tortoise's food plants is highly dependent on cool-season rains, the forage base could be reduced due to increasing temperatures and decreasing precipitation in winter. Although drought occurs routinely in the Mojave Desert, extended periods of drought have the potential to affect desert tortoises and their habitats through physiological effects to individuals (i.e., stress) and limited forage availability. To place the consequences of long-term drought in perspective, Longshore et al. (2003) demonstrated that even short-term drought could result in elevated levels of mortality of desert tortoises. Therefore, long-term drought is likely to have even greater effects, particularly given that the current fragmented nature of desert tortoise habitat (e.g., urban and agricultural development, Lakes allotments, which are located within critical habitat in the Western Mojave Recovery Unit;

current fragmented nature of desert tortoise habitat (e.g., urban and agricultural development, highways, freeways, military training areas, etc.) will make recolonization of extirpated areas difficult, if not impossible.

The Service notes in the 5-year review that the combination of the desert tortoise's late breeding age and a low reproductive rate challenges our ability to achieve recovery. When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action would "reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 Code of Federal Regulations 402.02). Although the Service does not explicitly address these metrics in the 5-year review, we have used the information in that document to summarize the status of the desert tortoise with respect to its reproduction, numbers, and distribution.

In the 5-year review, the Service notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease (Oftedal 2002 in Service 2010b), and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native forbs) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal et al. 2002; Tracy et al. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number that reaches adulthood. Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to negatively affect the reproduction of desert tortoises and recruitment into the adult population.

Data from long-term study plots, which were first established in 1976, cannot be extrapolated to provide an estimate of the number of desert tortoises on a range-wide basis; historic densities in some parts of the desert exceeded 100 adults in a square mile (Desert Tortoise Recovery Office 2014). Using data from the long-term study plots, the Service (2010b) concluded that "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly." Other sources indicate that local declines are continuing to occur. For example, surveyors found "lots of dead [desert tortoises]" in the western expansion area of Fort Irwin (Western Mojave Recovery Unit) in 2008 (Fort Irwin Research Coordination Meeting 2008). After the onset of translocation, coyotes killed 105 desert tortoises in Fort Irwin's southern translocation area (Western Mojave Recovery Unit); other canids may have been responsible for some of these deaths. Other incidences of predation were recorded throughout the range of the desert tortoise during this time (Esque et al. 2010). Esque et al. (2010) hypothesized that this high rate of predation on desert tortoises was influenced by low population levels of typical prey for coyotes due to drought conditions in previous years. Recent surveys in the Ivanpah Valley (Eastern Mojave Recovery Unit) for a proposed solar facility detected 31 live desert tortoises and the carcasses of 25 individuals that

had been dead less than 4 years (Ironwood 2011); this ratio of carcasses to live individuals over such a short period of time may indicate an abnormally high rate of mortality for a long-lived animal. In summary, the number of desert tortoises range-wide likely decreased substantially from 1976 through 1990 (i.e., when long-term study plots were initiated through the time the desert tortoise was listed as threatened), although we cannot quantify the amount of this decrease. Additionally, more recent data collected from various sources throughout the range of the desert tortoise suggest that local declines continue to occur (e.g., Bureau et al. 2005, Esque et al. 2010).

The distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 (Service 2010b) in terms of the overall extent of its range. Prior to 1994, desert tortoises were extirpated from large areas within their distributional limits by urban and agricultural development (e.g., the cities of Barstow, Lancaster, Las Vegas, St. George, etc.; agricultural areas south of Edwards Air Force Base and east of Barstow), military training (e.g., Fort Irwin, Leach Lake Gunnery Range), and off-road vehicle use (e.g., portions of off-road management areas managed by the Bureau and unauthorized use in areas such as east of California City). Since 1994, urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range. Desert tortoises have been essentially removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012e).

The following table depicts acreages of habitat (as modeled by Nussear et al. 2009) within various regions of the desert tortoise's range and of impervious surfaces as of 2006 (Xian et al. 2009). Impervious surfaces include paved and developed areas and other disturbed areas that have zero probability of supporting desert tortoises.

Regions[1]	**Modeled Habitat (acres)**	**Impervious Surfaces within Modeled Habitat**	**Percent of Modeled Habitat that is now Impervious**
Western Mojave	7,582,092	1,864,214	25
Colorado Desert	4,948,900	494,981	10
Northeast Mojave	7,776,934	1,173,025	15
Upper Virgin River	232,320	80,853	35
Total	20,540,246	3,613,052	18

[1]The regions do not correspond to recovery unit boundaries; we used a more general separation of the range for this illustration.

In conclusion, we have used the 5-year review (Service 2010b), revised recovery plan (Service 2011a), and additional information that has become available since these publications to review the reproduction, numbers, and distribution of the desert tortoise. The reproductive capacity of the desert tortoise may be compromised to some degree by the abundance and distribution of invasive weeds across its range; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the

species. Prior to its listing, the number of desert tortoises likely declined range-wide, although we cannot quantify the extent of the decline; since the time of listing, data suggest that declines continue to occur throughout most of the range, although recent information suggests that densities may have increased slightly in the Northeastern Mojave Recovery Unit. The continued increase in human access across the desert continues to expose more desert tortoises to the potential of being killed by human activities. The distributional limits of the desert tortoise's range have not changed substantially since the issuance of the original recovery plan in 1994; however, desert tortoises have been extirpated from large areas within their range (e.g., Las Vegas, other desert cities). The species' low reproductive rate, the extended time required for young animals to reach breeding age, and the multitude of threats that continue to confront desert tortoises combine to render its recovery a substantial challenge.

Status of Critical Habitat of the Desert Tortoise

The Service designated critical habitat for the desert tortoise in portions of California, Nevada, Arizona, and Utah in a final rule published February 8, 1994 (59 Federal Register 5820). The Service designates critical habitat to identify the key biological and physical needs of the species and key areas for recovery and to focus conservation actions on those areas. Critical habitat is composed of specific geographic areas that contain the biological and physical features essential to the species' conservation and that may require special management considerations or protection. These features, which include space, food, water, nutrition, cover, shelter, reproductive sites, and special habitats, are called the primary constituent elements of critical habitat. The specific primary constituent elements of desert tortoise critical habitat are: sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow; sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species; suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites; sufficient vegetation for shelter from temperature extremes and predators; and habitat protected from disturbance and human-caused mortality.

Critical habitat of the desert tortoise would not be able to fulfill its conservation role without each of the primary constituent elements being functional. As examples, having a sufficient amount of forage species is not sufficient if human-caused mortality is excessive; an area with sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow would not support desert tortoises without adequate forage species.

The final rule for designation of critical habitat did not explicitly ascribe specific conservation roles or functions to the various critical habitat units. Rather, it refers to the strategy of establishing recovery units and desert wildlife management areas recommended by the recovery plan for the desert tortoise, which had been published as a draft at the time of the designation of critical habitat, to capture the "biotic and abiotic variability found in desert tortoise habitat" (59 Federal Register 5820, see page 5823). Specifically, we designated the critical habitat units to follow the direction provided by the draft recovery plan (Service 1993a) for the establishment of

desert wildlife management areas. The critical habitat units in aggregate are intended to protect the variability that occurs across the large range of the desert tortoise; the loss of any specific unit would compromise the ability of critical habitat as a whole to serve its intended function and conservation role.

Despite the fact that desert tortoises do not necessarily need to move between critical habitat units to complete their life histories, both the original and revised recovery plans highlight the importance of these critical habitat units and connectivity between them for the recovery of the species. Specifically, the revised recovery plan states that "aggressive management as generally recommended in the 1994 Recovery Plan needs to be applied within existing (desert) tortoise conservation areas (defined as critical habitat, among other areas being managed for the conservation of desert tortoises) or other important areas … to ensure that populations remain distributed throughout the species' range …. (Desert tortoise) conservation areas capture the diversity of the Mojave population of the desert tortoise within each recovery unit, conserving the genetic breadth of the species, providing a margin of safety for the species to withstand catastrophic events, and providing potential opportunities for continued evolution and adaptive change …. Especially given uncertainties related to the effects of climate change on desert tortoise populations and distribution, we consider (desert) tortoise conservation areas to be the minimum baseline within which to focus our recovery efforts (pages 34 and 35, Service 2011a)."

The 12 critical habitat units range in area from 85 to 1,595 square miles. However, the optimal reserve size recommended to preserve viable desert tortoise populations was 1,000 square miles (Service 1994a); only 4 critical habitat units meet this threshold. Consequently, for some smaller critical habitat units, their future effectiveness in conserving the desert tortoise is largely dependent on the status of populations immediately adjacent to their boundaries or within intervening linkages that connect these smaller critical habitat units to other protected areas. Although the Service (1994a) recommended the identification of buffer zones and linkages for smaller desert tortoise conservation areas, land management agencies have generally not established such areas.

Population viability analyses indicate that reserves should contain from 10,000 to 20,000 adult desert tortoises to maximize estimated time to extinction (i.e., approximately 390 years, depending on rates of population change; Service 1994a). However, during the three most recent years of monitoring within the critical habitat units, only three (in 2009 and 2010) to five (in 2008) of the critical habitat units met this target (McLuckie et al. 2010; Service 2009, 2012a, 2012b). Some critical habitat units share boundaries and form contiguous blocks (e.g. Superior-Cronese and Fremont-Kramer Critical Habitat Units), and those blocks in California include combined estimated abundances of over 10,000 adult desert tortoises. These blocks are adjacent to smaller, more isolated units (e.g., Ord-Rodman Critical Habitat Unit) that are not currently connected to other protected habitat by preserved habitat linkages.

We did not designate the Desert Tortoise Natural Area and Joshua Tree National Park in California and the Desert National Wildlife Refuge in Nevada as critical habitat because they are "primarily managed as natural ecosystems" (59 Federal Register 5820, see page 5825) and

provide adequate protection to desert tortoises. Since the designation of critical habitat, Congress increased the size of Joshua Tree National Park and created the Mojave National Preserve. A portion of the expanded boundary of Joshua Tree National Park lies within critical habitat of the desert tortoise; portions of other critical habitat units lie within the boundaries of the Mojave National Preserve.

Within each critical habitat unit, both natural and anthropogenic factors affect the function of the primary constituent elements of critical habitat. As an example of a natural factor, in some specific areas within the boundaries of critical habitat, such as within and adjacent to dry lakes, some of the primary constituent elements are naturally absent because the substrate is extremely silty; desert tortoises do not normally reside in such areas. Comparing the acreage of desert tortoise habitat as depicted by Nussear et al.'s (2009) model to the gross acreage of the critical habitat units demonstrates quantitatively that the entire area within the boundaries of critical habitat likely does not support the primary constituent elements; see the following table. The acreage for modeled habitat is for the area in which the probability that desert tortoises are present is greater than 0.5. The acreages of modeled habitat are from Service (2012b); they do not include loss of habitat due to human-caused impacts. The difference between gross acreage and modeled habitat is 653,214 acres; that is, approximately 10 percent of the gross acreage of the designated critical habitat is not considered modeled habitat.

Critical Habitat Unit	**Gross Acreage**	**Modeled Habitat**
Superior-Cronese	766,900	724,967
Fremont-Kramer	518,000	501,095
Ord-Rodman	253,200	184,155
Pinto Mountain	171,700	144,056
Piute-Eldorado	970,600	930,008
Ivanpah Valley	632,400	510,711
Chuckwalla	1,020,600	809,319
Chemehuevi	937,400	914,505
Gold Butte-Pakoon	488,300	418,189
Mormon Mesa	427,900	407,041
Beaver Dam Slope	204,600	202,499
Upper Virgin River	54,600	46,441
Totals	6,446,200	5,792,986

Condition of the Primary Constituent Elements of Critical Habitat

Human activities can have obvious or more subtle effects on the primary constituent elements. The grading of an area and subsequent construction of a building removes the primary constituent elements of critical habitat; this action has an obvious effect on critical habitat. The revised recovery plan identifies human activities such as urbanization and the proliferation of roads and highways as threats to the desert tortoise and its habitat; these threats are examples of activities that have a clear effect on the primary constituent elements of critical habitat.

We have included the following paragraphs from the revised recovery plan for the desert tortoise (Service 2011a) to demonstrate that other anthropogenic factors affect the primary constituent elements of critical habitat in more subtle ways. All references are in the revised recovery plan (i.e., in Service 2011a); we have omitted some information from the revised recovery plan where the level of detail was unnecessary for the current discussion.

> Surface disturbance from [off-highway vehicle] activity can cause erosion and large amounts of dust to be discharged into the air. Recent studies on surface dust impacts on gas exchanges in Mojave Desert shrubs showed that plants encrusted by dust have reduced photosynthesis and decreased water-use efficiency, which may decrease primary production during seasons when photosynthesis occurs (Sharifi et al. 1997). Sharifi et al. (1997) also showed reduction in maximum leaf conductance, transpiration, and water-use efficiency due to dust. Leaf and stem temperatures were also shown to be higher in plants with leaf-surface dust. These effects may also impact desert annuals, an important food source for [desert] tortoises.
>
> [Off-highway vehicle] activity can also disturb fragile cyanobacterial-lichen soil crusts, a dominant source of nitrogen in desert ecosystems (Belnap 1996). Belnap (1996) showed that anthropogenic surface disturbances may have serious implications for nitrogen budgets in cold desert ecosystems, and this may also hold true for the hot deserts that [desert] tortoises occupy. Soil crusts also appear to be an important source of water for plants, as crusts were shown to have 53 percent greater volumetric water content than bare soils during the late fall when winter annuals are becoming established (DeFalco et al. 2001). DeFalco et al. (2001) found that non-native plant species comprised greater shoot biomass on crusted soils than native species, which demonstrates their ability to exploit available nutrient and water resources. Once the soil crusts are disturbed, non-native plants may colonize, become established, and out-compete native perennial and annual plant species (DeFalco et al. 2001, D'Antonio and Vitousek 1992). Invasion of non-native plants can affect the quality and quantity of plant foods available to desert tortoises. Increased presence of invasive plants can also contribute to increased fire frequency.
>
> Proliferation of invasive plants is increasing in the Mojave and Sonoran deserts and is recognized as a substantial threat to desert tortoise habitat. Many species of non-native plants from Europe and Asia have become common to abundant in some areas, particularly where disturbance has occurred and is ongoing. As non-native plant species become established, native perennial and annual plant species may decrease, diminish, or die out (D'Antonio and Vitousek 1992). Land managers and field scientists identified 116 species of non-native plants in the Mojave and Colorado deserts (Brooks and Esque 2002).
>
> Increased levels of atmospheric pollution and nitrogen deposition related to increased human presence and combustion of fossil fuels can cause increased levels of soil nitrogen, which in turn may result in significant changes in plant communities (Aber et

> al. 1989). Many of the non-native annual plant taxa in the Mojave region evolved in more fertile Mediterranean regions and benefit from increased levels of soil nitrogen, which gives them a competitive edge over native annuals. Studies at three sites within the central, southern, and western Mojave Desert indicated that increased levels of soil nitrogen can increase the dominance of non-native annual plants and promote the invasion of new species in desert regions. Furthermore, increased dominance by non-native annuals may decrease the diversity of native annual plants, and increased biomass of non-native annual grasses may increase fire frequency (Brooks 2003).

This summary from the revised recovery plan (Service 2011a) demonstrates how the effects of human activities on habitat of the desert tortoise are interconnected. In general, surface disturbance causes increased rates of erosion and generation of dust. Increased erosion alters additional habitat outside of the area directly affected by altering the nature of the substrate, removing shrubs, and possibly destroying burrows and other shelter sites. Increased dust affects photosynthesis in the plants that provide cover and forage to desert tortoises. Disturbed substrates and increased atmospheric nitrogen enhance the likelihood that invasive species will become established and outcompete native species; the proliferation of weedy species increases the risk of large-scale fires, which further move habitat conditions away from those that are favorable to desert tortoises.

The following paragraphs generally describe how the threats described in the revised recovery plan affect the primary constituent elements of critical habitat of the desert tortoise.

<u>Sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow</u>.

In considering the following discussion, bear in mind the information provided previously in this biological opinion regarding the recommended and actual sizes of critical habitat units for the desert tortoise. The original recovery team based the recommended size of desert wildlife management areas on the amount of space required to maintain viable populations. (The recovery plan [Service 1994a] defined conservation areas for the desert tortoise as 'desert wildlife management areas;' we based the boundaries of critical habitat on the recovery team's general recommendation for the desert wildlife management areas.) The current low densities of desert tortoises within critical habitat units exacerbate the difficulties of effecting recovery within these areas.

Urban and agricultural development, concentrated use by off-road vehicles, and other activities of this nature completely remove habitat. Although we are aware of local areas within the boundaries of critical habitat that have been heavily disturbed, we do not know of any areas that have been disturbed to the intensity and extent that this primary constituent element has been compromised. To date, the largest single loss of critical habitat is the use of 18,197 acres of additional training land in the southern portion of Fort Irwin. In our biological opinion for that proposed action (Service 2012e), we stated:

> The proposed action would essentially eliminate the primary constituent elements from approximately 2.40 percent of the Superior-Cronese Critical Habitat Unit; additionally, the conservation role of the remainder of this critical habitat unit and the other critical habitat units has been compromised by substantial human impact on the second and sixth primary constituent elements. However, the protective measures that the Army implemented as part of the proposed action offset, at least to some extent, the adverse effects of the use of the additional training lands in the southern expansion area. Consequently, we have concluded that, although the second and sixth primary constituent elements are not functioning appropriately throughout most of designated critical habitat of the desert tortoise and the proposed action would result in substantial disturbance to 18,197 acres of the Superior-Cronese Critical Habitat Unit, the change in the condition of critical habitat brought about by the Army's proposed action (i.e., use of the southern expansion area for training and implementation of the conservation actions) is not likely to cause an overall decrease in the conservation value and function of the Superior-Cronese Critical Habitat Unit.

The widening of existing freeways likely caused the second largest loss of critical habitat. Despite these losses of critical habitat, which occur in a linear manner, the critical habitat units continue to support sufficient space to support viable populations within each of the six recovery units.

In some cases, major roads likely disrupt the movement, dispersal, and gene flow of desert tortoises. Highways 58 and 395 in the Fremont-Kramer Critical Habitat Unit and Fort Irwin Road in the Superior-Cronese Critical Habitat Unit are examples of large and heavily travelled roads that likely disrupt movement, dispersal, and gene flow. Roads that have been fenced and provided with underpasses may alleviate this fragmentation to some degree; however, such facilities have not been in place for sufficient time to determine whether they will eliminate fragmentation.

The threats of invasive plant species described in the revised recovery plan generally do not result in the removal of this primary constituent element because they do not convert habitat into impervious surfaces, as would urban development.

<u>Sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species</u>.

This primary constituent element addresses the ability of critical habitat to provide adequate nutrition to desert tortoises. As described in the revised recovery plan and 5-year review, grazing, historical fire, invasive plants, altered hydrology, drought, wildfire potential, fugitive dust, and climate change/temperature extremes contribute to the stress of "nutritional compromise." Paved and unpaved roads through critical habitat of the desert tortoise provide avenues by which invasive native species disperse; these legal routes also provide the means by which unauthorized use occurs over large areas of critical habitat. Nitrogen deposition from atmospheric pollution likely occurs throughout all the critical habitat units and exacerbates the

effects of the disturbance of substrates. Because paved and unpaved roads are so widespread through critical habitat, this threat has compromised the conservation value and function of critical habitat throughout the range of the desert tortoise, to some degree. See the Status of the Desert Tortoise section of this biological opinion for a map that depicts the routes by which invasive weeds have access to critical habitat; the routes shown on the map are a subset of the actual number of routes that actually cross critical habitat of the desert tortoise.

Suitable substrates for burrowing, nesting, and overwintering.

Surface disturbance, motor vehicles traveling off route, use of OHV management areas, OHV events, unpaved roads, grazing, historical fire, wildfire potential, altered hydrology, and climate change leading to shifts in habitat composition and location, storms, and flooding can alter substrates to the extent that they are no longer suitable for burrowing, nesting, and overwintering. Erosion caused by these activities can alter washes to the extent that desert tortoise burrows placed along the edge of a wash, which is a preferred location for burrows, could be destroyed. We expect that the area within critical habitat that is affected by off-road vehicle use to the extent that substrates are no longer suitable is relatively small in relation to the area that desert tortoises have available for burrowing, nesting, and overwintering; consequently, off-road vehicle use has not had a substantial effect on this primary constituent element.

Most livestock allotments have been eliminated from within the boundaries of critical habitat. Of those that remain, livestock would compact substrates to the extent that they would become unsuitable for burrowing, nesting, and overwintering only in areas of concentrated use, such as around watering areas and corrals. Because livestock grazing occurs over a relatively small portion of critical habitat and the substrates in most areas within livestock allotments would not be substantially affected, suitable substrates for burrowing, nesting, and overwintering remain throughout most of the critical habitat units.

Burrows, caliche caves, and other shelter sites.

Human-caused effects to burrows, caliche caves, and other shelter sites likely occur at a similar rate as effects to substrates for burrowing, nesting, and overwintering for the same general reasons. Consequently, sufficient burrows, caliche caves, and other shelter sites remain throughout most of the critical habitat units.

Sufficient vegetation for shelter from temperature extremes and predators.

In general, sufficient vegetation for shelter from temperature extremes and predators remains throughout critical habitat. In areas where large fires have occurred in critical habitat, many of the shrubs that provide shelter from temperature extremes and predators have been destroyed; in such areas, cover sites may be a limiting factor. The proliferation of invasive plants poses a threat to shrub cover throughout critical habitat as the potential for larger and more frequent wildfires increases.

In 2005, wildfires in Nevada, Utah, and Arizona burned extensive areas of critical habitat (Service 2010b). Although different agencies report slightly different acreages, the following table provides an indication of the scale of the fires.

Critical Habitat Unit	**Total Area Burned (acres)**	**Percent of the Critical Habitat Unit Burned**
Beaver Dam Slope	53,528	26
Gold-Butte Pakoon	65,339	13
Mormon Mesa	12,952	3
Upper Virgin River	10,557	19

The revised recovery plan notes that the fires caused statistically significant losses of perennial plant cover, although patches of unburned shrubs remained. Given the patchiness with which the primary constituent elements of critical habitat are distributed across the critical habitat units and the varying intensity of the wildfires, we cannot quantify precisely the extent to which these fires disrupted the function and value of the critical habitat.

Habitat protected from disturbance and human-caused mortality.

In general, the Federal agencies that manage lands within the boundaries of critical habitat have adopted land management plans that include implementation of some or all of the recommendations contained in the original recovery plan for the desert tortoise. (See pages 70 to 72 of Service 2010b.) To at least some degree, the adoption of these plans has resulted in the implementation of management actions that are likely to reduce the disturbance and human-caused mortality of desert tortoises. For example, these plans resulted in the designation of open routes of travel and the closure (and, in some cases, physical closure) of unauthorized routes. Numerous livestock allotments have been relinquished by the permittees and cattle no longer graze these allotments. Because of these planning efforts, the Bureau's record of decision included direction to withdraw some areas of critical habitat from mineral entry. Because of actions on the part of various agencies, many miles of highways and other paved roads have been fenced to prevent desert tortoises from wandering into traffic and being killed. The Service and other agencies of the Desert Managers Group in California are implementing a plan to remove common ravens that prey on desert tortoises and to undertake other actions that would reduce subsidies (i.e., food, water, sites for nesting, roosting, and perching, etc.) that facilitate their abundance in the California desert (Service 2008).

Despite the implementation of these actions, disturbance and human-caused mortality continue to occur in many areas of critical habitat (which overlap the desert wildlife management areas for the most part and are the management units for which most data are collected) to the extent that the conservation value and function of critical habitat is, to some degree, compromised. For example, many highways and other paved roads in California remain unfenced. Twelve desert tortoises were reported to be killed on paved roads from within Mojave National Preserve in 2011, and we fully expect that desert tortoises are being killed at similar rates on many other roads, although these occurrences are not discovered and reported as diligently as by the

National Park Service. Employees of the Southern California Gas Company reported two desert tortoises in 2011 that were crushed by vehicles on unpaved roads.

Unauthorized off-road vehicle use continues to disturb habitat and result in loss of vegetation within the boundaries of critical habitat (e.g., Coolgardie Mesa in the Western Mojave Recovery Unit); although we have not documented the death of desert tortoises as a direct result of this activity, it likely occurs. Additionally, the habitat disturbance caused by this unauthorized activity exacerbates the spread of invasive plants, which displace native plants that are important forage for the desert tortoise, thereby increasing the physiological stress faced by desert tortoises.

Although the Bureau has approved, through its land use planning processes, the withdrawal of areas of critical habitat from mineral entry, it has not undertaken the administrative procedures to complete withdrawals in all areas. Absent this withdrawal, new mining claims can be filed and further disturbance of critical habitat could occur.

Finally, the Bureau has not allowed the development of solar power plants on public lands within the boundaries of its desert wildlife management areas (which largely correspond to the boundaries of critical habitat). Conversely, the County of San Bernardino is considering the approval of the construction and operation of at least two such facilities within the boundaries of the Superior-Cronese Critical Habitat Unit north of Interstate 15 near the Minneola Road exit.

Summary of the Status of Critical Habitat of the Desert Tortoise

As noted in the revised recovery plan for the desert tortoise and 5-year review (Service 2011a, 2010b), critical habitat of the desert tortoise is subject to landscape level impacts in addition to the site-specific effects of individual human activities. On the landscape level, atmospheric pollution is increasing the level of nitrogen in desert substrates; the increased nitrogen exacerbates the spread of invasive plants, which outcompete the native plants necessary for desert tortoises to survive. As invasive plants increase in abundance, the threat of large wildfires increases; wildfires have the potential to convert the shrubland-native annual plant communities upon which desert tortoises depend to a community with fewer shrubs and more invasive plants. In such a community, shelter and forage would be more difficult for desert tortoises to find. Invasive plants have already compromised the conservation value and function of critical habitat to some degree with regard to the second primary constituent element (i.e., sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species). These effects likely extend to the entirety of critical habitat, given the numerous routes by which invasive plants can access critical habitat and the large spatial extent that is subject to nitrogen from atmospheric pollution. (See maps from previous sections of this biological opinion regarding the extent of the threat of invasive plants and the aggregate stress that multiple threats, including invasive plants, place on critical habitat.)

Critical habitat has been compromised to some degree with regard to the last primary constituent element (i.e., habitat protected from disturbance and human-caused mortality) as a result of the wide variety of human activities that continues to occur within its boundaries. These effects

result from the implementation of discrete human activities and are thus more site-specific in nature.

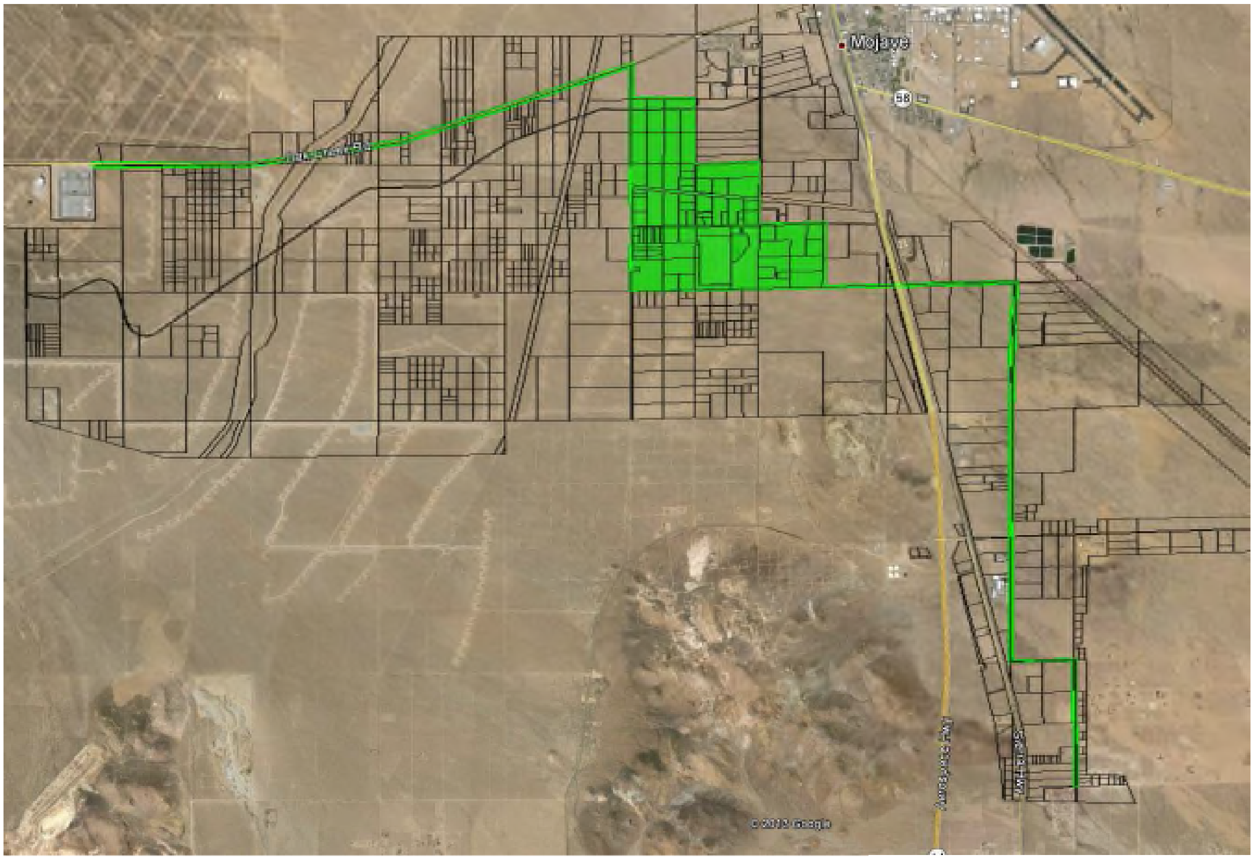
Although the remaining primary constituent elements have been affected to some degree by human activities, these impacts have not, to date, substantially compromised the conservation value and function of the critical habitat units. We have reached this conclusion primarily because the effects are localized and thus do not affect the conservation value and function of large areas of critical habitat.

Land managers have undertaken actions to improve the status of critical habitat. For example, as part of its efforts to offset the effects of the use of additional training maneuver lands at Fort Irwin (Service 2004), the Army acquired the private interests in the Harper Lake and Cronese Lakes allotments, which are located within critical habitat in the Western Mojave Recovery Unit; as a result, cattle have been removed from these allotments. Livestock have been removed from numerous other allotments through various means throughout the range of the desert tortoise. The retirement of allotments assists in the recovery of the species by eliminating disturbance to the primary constituent elements of critical habitat by cattle and range improvements.

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). The action area for this biological opinion is the footprint of Edwards Air Force Base, which consists of 307,516 acres, and the route of the gen-tie line from the proposed Oro Verde Solar Project in the northwestern corner of the base to the Windhub Substation, as depicted on the following map (Brewer-Anderson 2013). The precise route for the gen-tie line has not been finalized. The easement for the gen tie line would be 13.9 miles long and up to 110 feet wide. The easement would cover approximately 147 acres.



Habitat Characteristics of the Action Area

The following information provides a summary of the discussion of habitat characteristics from the biological evaluation (Air Force 2008a) and integrated natural resources management plan (Air Force 2008b). The proposed action area is located in the western portion of the Mojave Desert mid-way between the southern end of the Sierra Nevada and the San Bernardino Mountains. Edwards Air Force Base is visually dominated by three dry lakebeds: Rosamond, Rogers, and Buckhorn dry lakes. The area is characterized as high desert with broad expansive valleys bordered by low rocky hills.

The main plant communities on base include creosote bush scrub, saltbush scrub, Joshua tree woodland, and mesquite woodland. The zonal plant communities are primarily based on soil characteristics and elevation; elevation ranges on the base range between 2,500 to 3,300 feet, and topography gradually slopes from west to east. Vegetation in the upland areas on base consists of two main plant communities: creosote bush scrub and Joshua tree woodland. Lowland communities consist of the alkali sink and saltbush communities.

Existing Conditions in the Action Area

In this section, we discuss the anthropogenic and natural conditions in the action area as they relate to desert tortoises and their habitat. Unless we have noted otherwise by citing a biological opinion, the anthropogenic conditions present in the action area were constructed or instituted prior to the listing of the desert tortoise. We summarized the following information from the biological evaluation (Air Force 2008a), integrated natural resources management plan (Air Force 2008b), and communications with Edwards Air Force Base personnel.

Land Use

Edwards Air Force Base is divided into 7 environmental management areas or support zones to better manage the variety of environmental management programs. Figure 3-2 in the integrated natural resource management plan depicts the boundaries of each support zone.

The first zone is a relatively isolated developed area which contains the Air Force Research Laboratory. This area is surrounded by the Precision Impact Range Area in the northeastern portion of the base; desert tortoises are occasionally encountered in this zone.

The second and third zones are composed of main base south and main base north, respectively. Main base south supports areas developed for residential, recreational and commercial use. Main base north is the third zone and supports developed and undeveloped areas; developments in this area support a wide range of operations conducted by the base. Environmental issues in this zone include off-road vehicle areas and the presence of desert tortoise populations.

Zones four and five were developed to support flightline activities. The fourth zone, which is south base, is the original flightline that now primarily functions as a taxiway. Zone five contains the flightline, taxiways and associated hangars. Environmental issues of concern while operating in zone five include desert tortoise and habitat recovery.

The sixth environmental zone consists of the north base and Precision Impact Range Areas. The Precision Impact Range Area covers a large portion of the eastern part of the base and supports low-level aircraft flight-testing, open burn/open detonation facility, and various other facilities; this area also contains desert tortoise critical habitat. The Service (1994b) issued a biological opinion regarding the effects of establishing the Precision Impact Range Area on the desert tortoise and its critical habitat; in this biological opinion, we concluded that the proposed action was not likely to jeopardize the continued existence of the desert tortoise or destroy or adversely modify its critical habitat because of implementation of numerous measures intended to minimize the effects of the proposed action on desert tortoises. The open burn/open detonation area on the Precision Impact Range Area is equipped with desert tortoise exclusion fencing to prevent individuals from entering the facility; due to regular grading, very little vegetation persists within or immediately adjacent to the fenced area of the open burn-open detonation unit. Zone seven comprises undeveloped lands used for a wide variety of base activities including, but not limited to buffer zone around the three lakebeds, aircraft drop zones, shooting ranges,

training area, and lakebed runways. Environmental issues in this management area include desert tortoise, water wells, unpaved roads and emergency landing areas.

The Service has issued biological opinions regarding the effects of establishing, operating, and maintaining a suite of facilities and training areas throughout Edwards Air Force Base on the desert tortoise and its critical habitat. Desert tortoises have been translocated from the areas as necessary to successfully carry out the proposed actions and minimize impacts to desert tortoise. We concluded that the proposed actions were not likely to jeopardize the continued existence of the desert tortoise or destroy or adversely modify its critical habitat; we expect that these actions led to an overall decrease in the number of individuals in these areas.

The type and frequency of use varies greatly between areas. Some areas are heavily used and others remain virtually untouched (Air Force 2008b). Large areas of the base remain undeveloped and accommodate testing activities. A perimeter fence was installed around the base to help conserve desert tortoise habitat, in particular critical habitat. Areas designated as desert tortoise critical habitat require personnel to follow different levels of protection measures based upon the activities planned within that area.

The Air Force has re-vegetated areas disturbed by wildfire burns, unused vehicle routes, abandoned targets, closed borrow pits, closed landfills, and other areas within desert tortoise habitat. As of May 2013, the base has re-vegetated approximately 135 acres of habitat (much of which took place in previously burned areas) (Air Force 2014a). Of this amount, approximately 55 acres are located in critical habitat on the Precision Impact Range Area.

Impacts to natural resources may result in the release of hazardous substances, pollutants, and contaminants into the environment from mission-related activities. The Service issued five biological opinions regarding the effect of the Installation Restoration Program on desert tortoises and its critical habitat; in the biological opinions, we concluded that the proposed actions were not likely to jeopardize the continued existence of the desert tortoise or destroy or adversely modify its critical habitat because a reduction in disturbance is likely to benefit desert tortoises by reducing the amount of habitat that is lost or degraded.

The area between the northwest corner of the base and the Windhub Substation generally supports desert habitat with some scattered residences and businesses. The western end of the gen-tie line crosses through areas that have been developed as wind farms.

Use by Feral and Domestic Livestock

One of the primary historic uses of the land within Edwards Air Force Base included livestock grazing. Although livestock grazing has not legally occurred on base since 1950, portions are still recovering from past overgrazing practices. Illegal sheep grazing occasionally occurred along the northern boundary of the base; installation of boundary fence along the base perimeter has eliminated this problem. Sheep grazing still occurs around the base periphery resulting in some edge effects. Sheep likely occasionally graze in areas along the route of the proposed gen-tie line.

Non-native Species

The processes of grazing, urbanization, agriculture, and road and utility construction have resulted in the introduction of invasive annuals to the native flora, particularly split grass (*Schismus barbatus*), cheat grass (*Bromus tectorum*), and red brome (*Bromus madritensis* ssp. *rubens*). More recently, Sahara mustard (*Brassica tournfortii*) has spread into the western Mojave Desert from the Colorado Desert; it has been observed along U.S. Highway 395 along the edge of the eastern boundary of the base. We expect the abundance of these species to be higher in portions of the base that experienced the most recent livestock grazing.

The abundance and diversity of non-native species in any area vary in relation to the seasonal weather; consequently, the composition of the non-native plant flora may be substantially different from year to year. An overabundance of weedy species likely compromises the nutritional status of desert tortoises, as we discussed in the Status of the Species section of this biological opinion. We do not have specific information on the distribution of non-native species nor on their specific effects on desert tortoises in the action area.

Paved and Unpaved Roads

Highway 395 traverses the northeast corner of Edwards Air Force Base. State Route 58 parallels the northern boundary, with the exception of a small portion that crosses into the base. The construction of Highway 395 and State Route 58 resulted in the loss of viable desert tortoise habitat and poses as a barrier to movement of desert tortoises; we anticipate that at least a few desert tortoises are killed on these roads annually. State Highway 14 crosses the proposed route of the gen-tie line at about its midpoint. Furthermore, we expect that desert tortoise densities adjacent to these major roads are depressed, as discussed by Hoff and Marlow (2002), but we are not aware of surveys that quantify this effect in these specific areas.

The paved roads within the base are focused in areas supporting development and urbanization. The Service (1993b) issued a biological opinion that concluded that the proposed maintenance and repair of roads throughout the base was not likely to jeopardize the continued existence of the desert tortoise or destroy or adversely modify its critical habitat because most of the proposed actions would occur in previously disturbed areas.

In addition to the paved roads within the base, unpaved roads also traverse the action area. One of the primary historic uses of the land within Edwards Air Force Base included off-road and off-highway vehicle activities. Currently, off-road driving is generally prohibited except for within three designated off-road vehicle areas on base (see figure 7-8 in Air Force 2008b). Off-road vehicle area 1 is approximately 100 acres and designated only for use by the Desert Wheels Motorcycle Club. Off-road vehicle area 2 is approximately 15,040 acres located west of military family housing and is jointly used for off-road vehicles, equestrians, and general recreation. Off-road vehicle area 3 is approximately 4,328 acres, including 32 miles of trails, and is only used for non-motorized mountain biking and jogging. No motorized off-road vehicles are permitted in this area. The Service (1996) issued a biological opinion to the Air Force that considered the

effects of establishment and continued use of off-road vehicle area 2 on the desert tortoise. We concluded that the proposed action was not likely to jeopardize the continued existence of the desert tortoise. We expect that recreational use of these areas likely results in the death or injury of desert tortoises.

In July 2002, the Air Force (2008a) had installed approximately 42 miles of desert tortoise exclusion fencing throughout the base. The Air Force fenced roads to reduce injury and mortality to desert tortoises associated with their use. However, the Air Force subsequently determined that the increased fragmentation of habitat and barriers to movement could outweigh the benefit of reducing the injury and mortality of desert tortoises. Edwards Air Force Base currently has approximately 13 miles of desert tortoise exclusion fencing along areas where desert tortoises and threats overlap (Mull 2013b). The Air Force continues to evaluate the need for desert tortoise barrier fencing along roads to maintain connectivity of adjacent habitat.

Since the listing of the desert tortoise, five known desert tortoise deaths have occurred on Edwards Air Force Base; most of the deaths resulted from desert tortoises getting run over by mission-related traffic (Mull 2013c, 2013d). Environmental Management has closed rarely used dirt roads on portions of the base by constructing barriers across those roads; more road closures are planned in the future. New road construction is limited on base. Edwards Air Force Base personnel are encouraged to use existing roads for access throughout the base whenever possible. New roads were created in the past for projects; however, for many years, new projects have been designed to use existing roads as much as possible.

Utilities

Several underground utilities have been constructed in the northern border of the base paralleling State Highway 58. The Service (1995) issued a biological opinion to the Air Force that considered the effects of installing underground communication lines and related facilities at Edwards Air Force Base. We concluded that the proposed action was not likely to jeopardize the continued existence of the desert tortoise.

Large utility poles occur along the eastern boundary paralleling Highway 395. Utility construction on the base from the south and west has also occurred along well-traveled roads. These utilities were installed in the road shoulder or beneath paved or unpaved roads, which presents no new ground disturbance to the habitat adjacent to the road.

The most substantial ongoing effect of utility poles is their ongoing use by common ravens for perching and nesting. The presence of this additional nesting substrate, which allows common ravens to nest far above the reach of ground-dwelling predators, likely contributes substantially to the increase in the number of common ravens in the desert. As previously discussed, common ravens prey on desert tortoises and are likely detrimental to the recovery of the desert tortoise. The need for road maintenance on the utility corridors has left permanent bare areas. Roads along and above utility corridors are occasionally used for maintenance. As we previously

mentioned, the Air Force participates in ongoing re-vegetation efforts which aide in reducing impacts from the establishment of utility corridors.

Status of the Desert Tortoise in the Action Area

The Air Force conducted four major surveys throughout the base between 1991 and 1994 to determine relative density estimates of the desert tortoise. With some exceptions, results of these surveys indicate desert tortoises occur throughout the base, but are not uniformly distributed. Approximately 126 square miles (27 percent) of the base were excluded due to lack of desert tortoise habitat (e.g., dry lake beds, cantonment areas, research facilities, graded targets, housing areas, and other operational areas). The Air Force repeated these density surveys from 2006 through 2007 following the same methodology employed during the 1991 to 1994 surveys.

The Air Force used the total corrected sign method to conduct these surveys. In this methodology, surveyors record the amount of desert tortoise sign (e.g., scat, barrows, etc.) observed while walking transects and then develop a density estimate by calibrating the results against densities on long-term study plots, where the density of desert tortoises had been previously estimated using mark-recapture studies. This technique provides an index of relative density only and is no longer used for several reasons.

The following table summarizes results of surveys conducted from 1991 to 1994 and from 2006 to 2007 (Air Force 2008b, Air Force 2010). Although the absolute numbers may be questionable, the comparison of average densities between the two survey periods seems to indicate that the number of desert tortoises on Edwards Air Force Base has declined.

Survey Period	**Density range (individuals per square mile)**	**Average density (individuals per square mile)**
1991-1994	3 to 69	15.9
2006-2007	0 to 58	7.8

Results of the 2006 to 2007 surveys indicate that the relative density of desert tortoises are approximately twice as high near designated critical habitat and within the eastern portion of the base as they are on the west side. The mean relative density of desert tortoises on the east side of the base was 10.3 per square mile; on the west side, the mean relative density was 5.1 desert tortoises per square mile. Fewer desert tortoises are observed along the lakebeds and in the southwestern portions of the base. We added the densities of the areas surveyed and estimated that approximately 2,643 desert tortoises occurred on Edwards Air Force Base at the time of the 2006 and 2007 surveys; because of the variability associated with this methodology, we emphasize that this number represents a very rough estimate.

As we discussed in the Existing Conditions in the Action Area section, we expect that State Routes 58, which borders a portion of the northern edge of the base, and 395, which crosses its

northeastern tip, have likely resulted in a decrease in the numbers of desert tortoises adjacent to these roads. The number of desert tortoises on base has also likely been affected to a degree by the extensive human activity at Edwards Air Force Base that occurred prior to the listing of the species in 1989 (e.g., development of the main base, housing areas, bombing ranges and training areas, etc.; see Appendix B in Air Force 2008a). Finally, desert tortoises on base likely experienced an overall decrease in density as a result of the same factors that affected desert tortoises throughout the western Mojave Desert as we discussed in the Status of the Species section of this biological opinion.

The following table depicts the numbers of desert tortoises that have been killed or moved from harm's way as a result of the Air Force's activities under its active biological opinions (Mull 2013d). As in every action that covers a large area, we expect that the Air Force did not detect all injuries and mortalities. Because the number of desert tortoise mortalities is lower than the number moved from harm's way and substantially lower than the number of observations, we expect that the Air Force's protective measures are generally functioning well and that few animals have been killed or injured as a result of the activities.

Biological opinion	**Total number of Desert Tortoises**		
	Observed	**Mortalities**	**Moved from harm's way**
1-6-91-F-28	3	1	1
1-6-92-F-61	1	0	3
1-8-93-F-5	9	0	2
1-8-93-F-18	0	0	0
1-8-93-F-23	18	0	1
1-8-93-F-32	1	0	1
1-8-93-F-35	0	0	0
1-8-94-F-6	68	2	16
1-8-94-F-19	6	0	0
1-8-94-F-25	0	0	0
1-8-95-F-1	0	0	0
1-8-95-F-6	0	0	0
1-8-95-F-31	1	0	0
1-8-96-F-10	2	0	1
1-8-96-F-45	11	0	0
1-8-96-F-56	0	0	0
1-8-97-F-10	73	2	40
1-8-97-F-38	3	0	0
1-8-98-F-21R	0	0	0
1-8-99-F-58	0	0	0
Total	196	5	65

Total number of desert tortoise observations, mortalities, and moved from harm's way under biological opinions for Edwards Air Force Base from January 1, 1997 to May 31, 2013.

The Air Force is unlikely to find every desert tortoise that dies as a result of its activities. Although we expect that the Air Force's activities have killed more than 5 desert tortoises since its listing, we also expect that the overall number of animals that have died is unlikely to be substantially more than that observed by the Air Force. We have reached this conclusion because the generally low density of desert tortoises on base likely decreases the frequency of interactions between the Air Force's activities and desert tortoises. Additionally, the intensity of monitoring employed by the Air Force and the general high level of awareness of desert tortoises by base personnel in general likely add further protection to individuals of this species.

We expect that desert tortoises occur along the proposed easement for the gen-tie line in low numbers; we are aware of a few desert tortoises that have been detected in the area of the wind farms as a result of surveys conducted in that area. Sheep grazing and unauthorized off-road vehicle use have likely degraded the quality of habitat in this area and resulted in the deaths of desert tortoises. Because of the human activity associated with the residences and businesses, we expect that common ravens are common in this area and exert heavy predation pressure on desert tortoises. We also expect that the presence of State Route 14 has caused a local depression in the number of desert tortoises along the easement.

Status of Critical Habitat of the Desert Tortoise in the Action Area

Approximately 65,554 acres of the Fremont-Kramer Critical Habitat Unit are generally located on the south central and eastern portions of Edwards Air Force Base (Air Force 2008b); this area includes portions of Air Force research facilities and the Precision Impact Range Area. (See figure 5-7 in Air Force 2008b). The Air Force did not provide information on the overall condition of the primary constituent elements of critical habitat within the boundaries of Edwards Air Force Base. In general, we expect that the condition of the primary constituent elements within the installation is similar to that within the remainder of the Fremont-Kramer Critical Habitat Unit. That is, although we expect that the first, third, fourth, and fifth primary constituent elements have been affected to some degree by the Air Force's activities, these impacts have not, to date, substantially compromised the conservation value and function of the critical habitat. We expect that invasive plants have compromised the conservation value and function of critical habitat to some degree with regard to the second primary constituent element (i.e., sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species). Because most of the critical habitat within Edwards Air Force Base experiences fewer disturbances than public lands off base, we expect that the sixth primary constituent element (i.e., habitat protected from disturbance and human caused mortality) has not been appreciably affected by human activities.

The Air Force's activities contribute to the less-than-prime condition of the second primary constituent element. As previously mentioned in the Environmental Baseline, desert tortoise critical habitat is present within the Precision Impact Range Area on base; this area is divided into three management zones that roughly correspond with mission use in each zone. Zone 1 is a designated 4,681-acre area that experiences the heaviest use within the Precision Impact Range Area and critical habitat. Approximately 27,902 acres of critical habitat fall within the area

designated as Zone 2, this area experiences a moderate level of activity that is expected to continue at its current rate. Zone 3 encompasses 31,254 acres of the Precision Impact Range Area. Very little activity occurs within this area. The remaining critical habitat on base that is not associated with the three management zones is 1,717 acres.

The following table shows the total acres of habitat disturbance and re-vegetation efforts in desert tortoise critical habitat under active biological opinions for Edwards Air Force Base. The total acres of disturbance and re-vegetation comprise approximately 0.16 and 0.09 percent of the amount of critical habitat that lies with the boundaries of Edwards Air Force Base, respectively. We adapted the table from Mull (2013d) to include only biological opinions in which habitat disturbance or re-vegetation efforts occurred in areas designated as critical habitat.

Biological opinion	**Total acres of desert tortoise critical habitat disturbed**		**Total acres of re-vegetation**
	Permanent	**Temporary**	
1-8-93-F-23	0.5846	1.59	0
1-8-94-F-6	12.452	79.036	55.45
1-8-94-F-19	0	1.77	0
Total	**13.0366**	**82.396**	**55.45**

Total acres of habitat disturbance and re-vegetation in desert tortoise critical habitat under biological opinions for Edwards Air Force Base from 1 January 1997 – 31 May 2013.

EFFECTS OF THE ACTION

As we described in the Description of the Proposed Action section of this biological opinion, the Air Force and Service evaluated each of the Air Force's proposed activities and listed the aspects of the activity that may affect desert tortoises or their habitat (including critical habitat). In this section of the analysis, we will provide a general description of how these various aspects affect desert tortoises and their habitat (including critical habitat).

After we review the general mechanisms of how the Air Force's activities may affect desert tortoises and their critical habitat, we will analyze the potential effects of the injury or death of up to 5 desert tortoises per year and the loss of up to 5,000 of critical habitat and 15,000 acres outside of critical habitat. The Air Force and Service developed these numbers as thresholds upon which to base the analysis of Future Development in this biological opinion and to provide a trigger for the re-initiation of formal consultation.

Desert tortoises less than 160 millimeters in length (including hatchlings and eggs) are difficult to detect. Surveyors are less likely to detect them than desert tortoises greater than 160 millimeters because hatchlings can take shelter in burrows of all sizes and are difficult to see due to their cryptic nature and their small size. Consequently, we expect that most hatchlings and eggs likely remain in work areas that have been cleared of larger desert tortoises. We anticipate that future activities are likely to result in injury or mortality of small (i.e., less than 160

millimeters in length) desert tortoises because they are more difficult to detect. Because of their cryptic nature and small size, these mortalities have potential to go undetected. We acknowledge that smaller desert tortoises and eggs may be killed during the implementation of the Air Force's activities; however, because they are difficult to detect and because larger individuals are more important for the long-term conservation of the species, we focused our analysis on larger individuals.

Driving Off Roads

Desert Tortoise

In general, the use of vehicles off of roads (paved or unpaved) can injure or kill desert tortoises; vehicles traveling off road can also crush desert tortoise burrows trapping individuals in their collapsed burrows. In contrast to recreational off-highway vehicle use, where numerous vehicles travel off road at high speeds and with little or no regard to natural resources, the Air Force's use of vehicles off road are prohibited under normal conditions, but limited off-road use may be required in emergencies or to support specific mission requirements. Because the off-road activities associated with range-ground operations and the expenditure of ordnance and energetic materials are expected to be infrequent and these activities would be controlled by the Air Force, we expect that use of vehicles off paved or unpaved roads is likely to injure or kill few desert tortoises.

Critical Habitat

In general, the use of vehicles off of roads (paved or unpaved) can destroy plants needed for cover and food, erode and compact substrates, cause proliferation of weeds, and increase in the number and location of wildfires. We do not expect that the use of vehicles off of roads, at the extent likely to be conducted by the Air Force, would have a measurable effect on the first primary constituent element of critical habitat (sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow). We have reached this conclusion because the Air Force's use would be infrequent and monitored to the extent that it would not reduce the amount of habitat within critical habitat and prevent movement, dispersal, and gene flow.

The second through fifth primary constituent elements (sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species; suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites; sufficient vegetation for shelter from temperature extremes and predators) are related to the biological and physical aspects of critical habitat. We expect the low level of use of vehicles off roads, which will be appropriately monitored, would not affect the function of these aspects of the desert tortoise's habitat in a measurable manner.

This aspect of the Air Force's activities would minimally affect the sixth primary constituent element (habitat protected from disturbance and human caused mortality) because it would occur infrequently and be monitored.

Driving on Roads

Desert Tortoise

Desert tortoises are generally more easily observed on roads, because of their more even surfaces and lack of plant cover. Roads often allow vehicles to travel at higher speeds, which reduce the likelihood of drivers detecting and avoiding desert tortoises. Rises and turns in roads also decrease the ability of drivers to detect desert tortoises. Along heavily used roads, the number of desert tortoises is depressed for some distance from the edge of the road as a result of road-associated mortality; this distance varies with the level of use of the road. In general, vehicle use is likely to result in at least some mortalities of and injuries to desert tortoises; the extent of the loss is related to the condition of the road, the time of the year when vehicle use occurs, the abundance of desert tortoises, and the awareness of the driver. Even the most careful drivers may occasionally strike a desert tortoise.

To date, most of the reported desert tortoise mortalities that have occurred in the action area resulted from vehicles driving over them on roads during permitted activities (Mull 2013c). Additionally, personnel have moved many more from roadways. The Air Force addresses this threat in its protective measures by posting signs for reduced speed limits where appropriate. We expect this threat to persist throughout the action area.

Critical Habitat

The use of existing roads will not affect the second through fifth primary constituent elements because these physical and biological aspects of critical habitat are no longer present within roads. Roads that experience high levels of traffic can essentially form a barrier to movement, dispersal, and gene flow (first primary constituent element); we do not expect that any roads within Edwards Air Force Base within desert tortoise habitat experience this level of traffic. High levels of traffic may affect the sixth primary constituent element (habitat protected from disturbance and human caused mortality) by increasing the number of desert tortoises that are injured or killed; we do not anticipate that traffic levels in desert tortoise habitat would rise to such levels.

Ground Disturbance

Desert Tortoise

We consider ground disturbance to include any activity where the Air Force's activities disrupt vegetation and substrate through the use of heavy equipment and materials. Desert tortoises may be injured or killed or trapped in their burrows during these activities. Some of the Air Force's

activities may cause negligible amounts ground disturbance. Conversely, the construction of a new target or building may result in ground disturbance over a larger area.

Because the Air Force would use standard and successful measures and experienced staff to avoid injuring or killing desert tortoises during ground-disturbing activities, we expect that relatively few individuals are likely to be injured or killed as a result of ground disturbance.

Critical Habitat

Ground disturbance has the potential to adversely affect all the primary constituent elements of critical habitat. Small amounts of ground disturbance that are temporary in nature would generally affect critical habitat less than larger areas of permanent disturbance, although some indirect effects of smaller projects (e.g., the proliferation of weeds) can extend well beyond the temporal and spatial footprint of a project.

Explosions

Desert Tortoise

Ordnance or other materials associated with explosions could strike a desert tortoise directly. Additionally, unforeseen explosions such as an accidental crash of an unmanned aerial vehicle could also strike and injure or kill a desert tortoise. Such events are likely extremely rare, given the large area of the target sites, the sparse distribution of desert tortoises, and the relatively small area that the explosion would affect. Additionally, the Air Force's standard practice is to check areas within desert tortoise habitat before emergency scheduled explosions occur to remove any desert tortoises that may be present. Some potential exists that large explosions can cause over pressure vibrations that would cause nearby burrows to collapse and trap desert tortoises inside.

Desert tortoises may be injured by noise associated with explosions. Bowles et al. (1999) found that subsonic and supersonic aircraft noise did not elicit substantial responses from desert tortoises. If a desert tortoise were close to a large explosion, however, we expect that the noise would have the potential to cause physical damage to the animal. Because the Air Force inspects areas and would remove desert tortoises before explosions occur, few desert tortoises are likely to be injured or killed by explosions.

The Air Force's use of the target sites and open burn/open detonation facilities can reasonably be expected to start fires under the appropriate conditions. Therefore, we will consider these fires as a likely effect of explosions. Desert tortoises may be burned to death from fires started by weapons testing, open burn/open detonation activities in areas containing vegetation, lightning or aircraft crashes (Air Force 2008a). Fires can injure or kill desert tortoises that are away from their burrows; the use of fire equipment to fight fires could also kill desert tortoises. Larger fires during times of the year and day when desert tortoises are active are more likely to injure or kill desert tortoises than smaller fires when desert tortoises are inactive (i.e., in their burrows). Desert tortoises are less likely to be present in areas that have repeatedly burned, where non-

native grasses predominate; to the extent that at least some fires occur in such areas, the risk of desert tortoises being injured or killed by fire is somewhat reduced.
The Air Force's fire management measures are likely to reduce the potential for fires started at target sites. This measure is protective of desert tortoises because fires can kill desert tortoises that may be above ground.

Critical Habitat

The Air Force's use of explosives would not directly impair the value and function of critical habitat with regard to the first primary constituent element (sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow). We have reached this conclusion because the explosions occur in relatively small areas that are used repeatedly. Most explosions would likely occur in areas that have been previously used for such work. However, if a large fire spread from target sites, the potential exists that habitat conditions could be altered to the extent that desert tortoises would no longer traverse such areas.

Large explosions would likely alter the quality and quantity of forage species and the soil conditions to provide for the growth of these species in new target areas (the second primary constituent element); target areas that have been used previously likely no longer support these features. Smaller explosions likely have little or no direct effect on this primary constituent element. As we previously discussed, fire spreading from a target area would likely reduce the value and function of this primary constituent element.

Large explosions likely damage substrates for burrowing, nesting, and overwintering (third primary constituent element) and burrows, caliche caves, and other shelter sites (fourth primary constituent element). Because most explosions would occur in previously used, defined target areas, damage to substrates and shelter sites is likely to be minimal. Fire may affect substrates and shelter sites if it removes sufficient plant cover to increase erosion during storm events. Large explosions would remove vegetation that desert tortoises use for shelter from temperature extremes and predators (the fifth primary constituent element), but generally in a limited area. This adverse effect would be reduced by the use of existing target sites. Fire would affect shelter sites provided by shrubs if it spreads beyond the disturbed target site.

The repeated use of target sites would reduce the potential for explosions to have a measurable effect on the sixth primary constituent element (habitat protected from disturbance and human-caused mortality) because the disturbance and potential for mortality of desert tortoises would be limited to a relatively small portion of critical habitat. Conversely, the creation of new bombing targets in critical habitat requires the Air Force to clear additional lands. As with the other primary constituent elements, fire that spreads beyond disturbed areas around the target sites would increase the adverse effect.

The Air Force's fire management measures likely reduce the potential that fires started at target sites would have a measurable effect on the primary constituent elements of critical habitat of the desert tortoise. One of the primary natural resources management goals of the base's integrated

natural resources management plan is to conserve natural resources in a manner consistent with the military mission and the base's wildland fire management plan by implementing effective suppression of wildland fires and minimizing fire and structural damage to biological resources (Air Force 2008b). Although Edwards Air Force Base has over 200,000 acres of unimproved vegetated terrain, the base has not had a history of a severe fire danger hazard over the past 25 years; lightning is the primary cause of fires on base (Air Force 2008b).

Non-native Plant Species

Desert Tortoise

Vehicles, ground disturbance, fire, and other human activities contribute to the dispersal of non-native plant species. These non-native plants include species that are already present in the California desert and newly introduced species. As we discussed in the Status of the Species and Critical Habitat section of this biological opinion, non-native plants can alter the quality and quantity of plant foods available to desert tortoises and thereby affect their nutritional intake.

Critical Habitat

The spread of non-native plant species may impair the value and function of the first primary constituent element (sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow) if they become so widespread and dense that they reduce the ability of desert tortoises to forage over wide areas. This threat is most prominent in the action area where fires have the potential to alter habitat conditions on a large scale.

As we discussed in the Status of Critical Habitat of the Desert Tortoise section of this biological opinion, the function and value of the second primary constituent element (sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species) have been compromised to some degree throughout the range of the desert tortoise. The Air Force's activities, particularly near targets where fires are more likely, may exacerbate this threat.

The spread of non-native plant species is not likely to affect the third and fourth primary constituent element (suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites). We have reached this conclusion because the plants would not generally affect substrates or shelter sites used by desert tortoises.

Non-native plant species can degrade vegetation that desert tortoises use to seek shelter from temperature extremes and predators (the fifth primary constituent element), primarily by supporting larger and more intense fires. Most shrubs in the California desert are not adapted to fire. Once fire kills these shrubs, they are unlikely to return, thus depriving desert tortoises of shelter sites.

Habitat that is degraded by the presence of a large component of non-native species has not been protected from disturbance and human-caused mortality (the sixth primary constituent element). Consequently, spread of non-native plant species has the potential to further degrade the value and function of this primary constituent element.

As we discussed in the Status of the Desert Tortoise section of this biological opinion, current information indicates that invasive species likely affect a large portion of the desert tortoise's range. Non-native species can occur in densities that can increase the risk of fires, which, in turn, destroy native species and may result in future habitat loss. Non-native plant species currently occur throughout Edwards Air Force Base (see Appendix B in 2008b). The Air Force's wildland fire management plan (Appendix H in Air Force 2008b) has potential to reduce the spread of non-native plant species by implementing effective suppression of wildland fires and minimizing fire and structural damage to biological resources. In the event of a wildfire that may affect desert tortoises or their critical habitat, the Air Force and Service would consult under the emergency provisions of section 7(a)(2) of the Endangered Species Act.

Common Ravens

Desert Tortoise

The Air Force has proposed to manage its trash and debris to reduce the attractiveness of Edwards Air Force Base to common ravens. This protective measure would likely be effective in reducing some level of food subsidies to common ravens. We expect that buildings and other structures on the Edwards Air Force Base would continue to provide common ravens with more perching, roosting, and nesting sites than would be found in a natural setting. We also expect that common ravens also derive at least some food and water from the residential area of the installation. Future development may lead to an increase in the number of people using the residential area, which may, in turn, increase the amount of food and water available to common ravens. Any increase in the number of common ravens would likely result in increased predation of desert tortoises.

Critical Habitat

Common ravens do not affect the primary constituent element of critical habitat.

Moving Desert Tortoises from Harm's Way

Desert Tortoise

Some potential exists that capturing desert tortoises to move them from harm's way may cause elevated levels of stress that may render these animals more susceptible to disease. Because the Air Force will use experienced biologists approved by the Service and approved handling techniques, collected desert tortoises are unlikely to experience elevated stress levels. Information from a translocation project at Fort Irwin indicates that translocation of desert

tortoises in that study did not cause a measurable physiological stress response (Drake et al. 2012). In the case of Fort Irwin, the animals were often moved far from their home ranges. Because the Air Force's activities are of a smaller scale, desert tortoises moved from harm's way would likely remain within their home ranges; therefore, we expect that the potential for these animals to be stressed is even lower.

Critical Habitat

Moving desert tortoises from harm's way will not affect critical habitat because this activity primarily involves the transport of individuals a relatively short distance by a biologist who is traveling on foot. Neither the desert tortoises themselves nor the personnel who transport them will affect the primary constituent elements of critical habitat. The construction of artificial burrows would disturb limited areas where annual plants could grow and their supporting substrates; however, this disturbance will not measurably affect the value or function of the primary constituent elements of critical habitat.

Personnel on Foot

Desert Tortoise

Because of their small size, hatchlings and slightly larger desert tortoises could be trampled by foot traffic. Nests are also vulnerable, but their typical location, near the mouth of a burrow, likely protects them to some degree.

We expect that few desert tortoises would be injured or killed in this manner because most Air Force personnel working in desert tortoise habitat will receive specific training, which would increase their awareness of this potential threat. Additionally, we expect that the likelihood of stepping on desert tortoises would generally be low because most activities involving personnel on foot would occur in a relatively limited area of the base and most frequently in situations where the Air Force has conducted surveys to protect desert tortoises.

Critical Habitat

This activity will not affect the primary constituent elements of critical habitat because of the general low level and intensity of use.

Habitat Conversion

Desert Tortoise

Various activities that the Air Force may undertake have the potential to cause habitat conversion. The act of converting habitat from an area that is suitable for desert tortoises into some other environment has the potential to kill the individuals living in that area. Generally, the

heavy equipment that is involved in the conversion of habitat would crush any desert tortoises that are present.

As we have discussed previously in this biological opinion, other factors, such as fire and an overabundance of non-native species can, either together or separately, covert an area of suitable habitat for desert tortoises into something that is far less able to support them. Over time, desert tortoises that are forced to live in such areas are likely to die as a result of starvation; prior to that, their reproductive output would likely be lower because of their poorer physiological condition.

Critical Habitat

Suitable habitat generally is that which contains the primary constituent elements of critical habitat in a functioning condition. In the context of critical habitat, habitat conversion would occur when the amount of disturbance or alteration of a primary constituent element removes its function or value. Any ground-based activity that the Air Force undertakes could potentially disturb or alter, to some degree, the primary constituent elements. As examples, the extensive use of off-road vehicles could decrease the amount of space needed to support a viable population of desert tortoises and to provide for movement, dispersal, and gene flow within the Western Mojave Recovery Unit. Vehicles traveling off roads could decrease the quality and quantity of forage species and the substrate conditions that support the growth of these species and for burrowing; off-road travel could also destroy burrows, caliche caves, and other shelter sites and the perennial vegetation that desert tortoises use for shelter from temperature extremes and predators. Off-road vehicle use would increase the amount of disturbance and human-caused mortality in the area in which it occurred.

Future Development

In this biological opinion, we considered future development to be any activity that the Air Force undertakes for which this biological opinion serves as compliance with the Endangered Species Act. Consequently, we consider the future injury or death of any desert tortoise that may result from an otherwise legal activity to have been analyzed in this biological opinion, provided that it is within the parameters proposed by the Air Force. With regard to habitat and critical habitat, we expect the Air Force to track any loss of habitat or critical habitat caused by any otherwise legal activity it conducts or authorizes. Disturbance resulting from activities that occur in previously disturbed areas that do not support the biological or physical attributes of desert tortoise habitat or in undisturbed natural areas that do not support desert tortoise habitat (e.g., dry lake beds) would not be considered to involve the loss of desert tortoise habitat.

Desert Tortoise

The regulatory definition of "to jeopardize the continued existence of the species" focuses on assessing the effects of the proposed action on the reproduction, numbers, or distribution of the species being considered in the biological opinion. For that reason, we have used those aspects

of the desert tortoise's status as the basis to assess the overall effect of the proposed action on the species.

In the first portion of the Effects of the Action section of this biological opinion, we provided a general description of how the various activities that the Air Force expects to undertake are likely to affect desert tortoises. In the following sections, we will use the proposed re-initiation threshold of five desert tortoises killed in a year to determine how the future operation of Edwards Air Force Base would affect the reproduction, number, and distribution of the desert tortoise. We will then assess the effects of the proposed action on the recovery of the species and whether it is likely to appreciably reduce the likelihood of both the survival and recovery of the desert tortoise. We reach our conclusion regarding whether an action is likely "to jeopardize the continued existence of the species" through an analysis of how a proposed action affects the listed taxon within the action area in relation to the range of the entire listed taxon. For the desert tortoise, this process involves considering the effects at the level of the action area, then at the level of the recovery unit (in this case, the Western Mojave Recovery Unit), and then finally for the range of the listed taxon. Logically, if an aspect of the proposed action is unlikely to cause a measurable effect within the action area, it is unlikely to affect the recovery unit or the remainder of the range.

Reproduction

The reproductive output of individuals of a species is determined in part by the species' breeding ecology, overall abundance of breeding individuals, and the condition of the habitat in which they live. The reproductive output of the desert tortoise is governed by several aspects of its breeding ecology: the delayed onset of breeding, many years of reproduction, high mortality rates of eggs and young, and low mortality rates among adults. If the population of desert tortoises at Edwards Air Force Base was stable or increasing, the loss of five individuals per year to human activities would be unlikely to have a measurable effect on its overall reproductive capacity. The long reproductive life of female desert tortoises and the normally low mortality rates among adult animals are factors that would protect the reproductive output of a population.

The overall abundance of breeding individuals would also influence how the loss of five desert tortoises per year affects their reproductive output at Edwards Air Force Base. In general, desert tortoises occur at low densities in most areas of the base; the highest density is 58 desert tortoises over one square mile. In some areas, their densities are extremely low. The effects of the mortality of five desert tortoises per year within Edwards Air Force Base may negatively affect the amount of reproduction for several reasons. First, the loss of even a small number of individuals in a low-density population could render finding mates more difficult. Second, desert tortoises require from 13 to 20 years to reach sexual maturity. Third, females produce a relatively small number of eggs per year. Fourth, desert tortoises also experience high mortality early in life (including as eggs). Consequently, even moderate downward fluctuations in adult survival rates can result in rapid population declines; slow reproductive rates and high juvenile mortality limit the capacity of populations to increase rapidly after a decline (Service 2011a).

The desert tortoise possesses two safeguards against the loss of reproduction in areas of low population density. First, female desert tortoises can store sperm for several years; this trait provides some hedge against low densities precluding reproduction because females do not need to encounter males every year to produce young. Second, breeding-age desert tortoises would continue to produce young over their long reproductive life; this reproductive output could replace individuals that are killed by the Air Force's activities.

The amount and timing of rainfall in the desert greatly influences the production of native annual plants upon which desert tortoises feed. A high diversity and abundance of annual plants provide desert tortoises with the appropriate quality and quantity of food to persist and to produce eggs. The widespread invasion of non-native annual plants has likely reduced the desert tortoise's ability to obtain the appropriate quality and quantity of forage plants on a consistent basis. Human disturbance of substrates and increased frequency of fires render desert habitat more susceptible to invasion by non-native annual plants. The Air Force does not implement specific measures to control weed infestations that its activities may cause. Consequently the Air Force's activities have the potential to indirectly affect desert tortoise habitat well outside the footprint of areas that it directly disturbs. Some potential exists that non-native plants are already established at Edwards Air Force Base to the degree that the Air Force's activities would not exacerbate the situation. If the Air Force introduced new species of invasive plants during its activities or expanded the area of infestation of invasive species already on base, the quality of desert tortoise habitat would likely further decrease; such a decrease would negatively affect the ability of Edwards Air Force Base to support the reproduction of desert tortoises at the highest levels of productivity.

Based on these factors, we conclude that the loss of five individuals per year to the Air Force's activities is likely to cause a minor depression of reproduction of desert tortoises at Edwards Air Force Base. We acknowledge that all five individuals may not be of reproductive age; the loss of non-reproductive individuals would not have an immediate effect on reproduction. We also acknowledge that the loss of younger animals would reduce their potential recruitment into breeding age individuals.

Our determination with regard to whether a proposed action is likely to jeopardize the continued existence of a species is based on the status of the listed taxon throughout its range and not just within the action area. Consequently, although the loss of five desert tortoises per year at Edwards Air Force Base is likely to cause a minor depression of reproduction of desert tortoises at Edwards Air Force Base, this loss is unlikely to have a measurable effect on the reproduction of desert tortoises within the Western Mojave Recovery Unit or range wide. We have reached this conclusion because Edwards Air Force Base comprises a small portion of the Western Mojave Recovery Unit and an even smaller portion of the species' range. The next section of this analysis provides insight into the numbers of desert tortoises within Edwards Air Force Base, the Western Mojave Recovery Unit, and range wide.

Number

We used the reports on range-wide sampling for the last 3 years (Service 2012b, 2012c, 2012d) to assess how the loss of 5 individuals per year at Edwards Air Force Base would affect the desert tortoise, first within the Western Mojave Recovery Unit (which is where Edwards Air Force Base is located) and then throughout its range. The numbers in the following table are desert tortoises that are greater than 180 millimeters in length that reside in the sampled areas of critical habitat and other desert tortoise conservation areas; because these numbers do not include smaller individuals and desert tortoises that reside outside the sampled areas, we expect that more desert tortoises occur in the Western Mojave Recovery Unit and throughout the range than are represented in this table. Because of the complexity involved with sampling desert tortoises on such a large scale, the changes in numbers from year to year are more likely from sampling error than actual trends or changes in the number of individuals.

Year	Area of Estimate	Number of Desert Tortoises		
		Estimated	Lower 95 Percent CI	Upper 95 Percent CI
2010	Western Mojave	20,264	13,153	31,329
	Range-wide	95,145	77,038	117,511
2011	Western Mojave	21,533	12,600	37,120
	Range-wide	99,568	69,324	143,007
2012	Western Mojave	22,260	19,894	46,735
	Range-wide	71,827	46,685	110,509

To assume the most conservative approach to this analysis, we assumed that the actual numbers of desert tortoises in the Western Mojave Recovery Unit and range wide were the lowest results from these 3 years (12,600 and 46,685). We also assumed that all five desert tortoises that die would be reproductive. These losses amount to approximately 0.04 and 0.01 percent of the number of desert tortoises over 180 millimeters within sampled areas in Western Mojave Recovery Unit and throughout the range; these percentages would decrease even further if we considered all desert tortoises through the entire recovery unit and range.

Because the Air Force's activities would continue over time, we also calculated how the loss of five individuals over a 20-year period would affect desert tortoise populations. The loss of 100 desert tortoises would comprise approximately 0.79 and 0.21 percent of the Western Mojave Recovery Unit and range-wide populations, respectively.

We acknowledge that we cannot predict whether the numbers of desert tortoises at Edwards Air Force Base, within the Western Mojave Recovery Unit, or range wide would change over the next 20 years. If the number of desert tortoises at Edwards Air Force Base decreases, we expect that the Air Force would encounter fewer individuals while it is implementing actions and, therefore, fewer individuals are likelier to die. If more desert tortoises number occur at Edwards Air Force Base in the future, the risk that desert tortoises would die at any given project would increase but the Air Force's proposed protective measures (including a commitment to re-initiate

formal consultation if five are killed in a year) would prevent an appreciable increase in mortalities.

Consequently, based on the best available information, we conclude that the loss of five desert tortoises per year is not likely to appreciably diminish the number of desert tortoises, either within the Western Mojave Recovery Unit or range wide.
We did not discuss the injury of desert tortoises in this section. The implementing regulations for section 7 of the Endangered Species Act at 50 Code of Federal Regulations 402.14(i)(1)(iv) require the Service to specify the procedures to be used to handle or dispose of any individuals of a species that is killed or injured during the implementation of a proposed action that has undergone formal consultation. Consequently, in the Incidental Take Statement - Disposition of Dead or Injured Specimens section of this biological opinion, we will direct the Air Force to take injured desert tortoises to a qualified veterinarian for treatment and to contact us regarding the final disposition any these animals. If they recover from their injuries to the extent that they can be released to the wild, these animals would not be included in the annual count of dead desert tortoises.

Distribution

Edwards Air Force Base occupies approximately 307,516 acres. Of this total, areas of unsuitable habitat (e.g., Buckhorn, Rogers, and Rosamond dry lakes), cantonment areas; research facilities, fenced operational areas, graded targets, other operational areas, and housing cover approximately 80,640 acres. Consequently, approximately 226,876 acres of desert tortoise habitat occur on base.

The Air Force has proposed to re-initiate formal consultation if 20,000 acres of desert tortoise habitat (15,000 acres outside of critical habitat boundaries and 5,000 within the boundaries of critical habitat) are disturbed by future development. This amount of long-term disturbance would comprise up to approximately 9.09 percent of the desert tortoise habitat on Edwards Air Force Base. Previous consultations with the Air Force generally involved numerous actions that affected scattered, relatively small areas of desert tortoise habitat across Edwards Air Force Base. We expect this general pattern to continue. One exception is the Air Force's proposal to allow for the development and operation of a large solar plant in the northwest corner of Edwards Air Force Base. This solar plant may occupy up to 4,000 acres. We do not have information on the final design of the plant at this time; however, some potential exists that the Air Force and operator would not exclude desert tortoises from the entire project area during its operation.

This future development, including the solar plant in the northwestern corner of the base, would reduce the amount of habitat on base and increase, to some degree, the amount of fragmentation on a local scale. Based on the Nussear et al. (2009, using values of 0.5 to 1) model and our calculations (Waln 2010), the Western Mojave Recovery Unit may support up to 10,316 square miles of desert tortoise habitat. Consequently, the proposed action would result in the loss of approximately 0.30 percent of the habitat in the Western Mojave Recovery Unit. (That is,

20,000 acres of disturbance divided by 640 acres per square mile equals 31.25 square miles. 31.25 square miles divided by 10,316 square miles equals 0.00302. 0.00302 multiplied by 100 equals 0.30 percent.) Because the area that may be disturbed at Edwards Air Force Base is a small proportion of the available habitat in the Western Mojave Recovery Unit and because most of the projects that the Air Force undertakes would be relatively small and scattered throughout

the base, we do not expect this loss of habitat to appreciably reduce the distribution of the desert tortoise with regard to the Western Mojave Recovery Unit.

This loss would comprise approximately 0.11 percent of the range-wide distribution of the desert tortoise, which covers approximately 28,417 square miles, using the values of 0.5 to 1 in the Nussear et al. (2009) model and our calculations (Waln 2010). (That is, 31.25 square miles of disturbance divided by 28,417 square miles equals 0.00109. 0.00109 multiplied by 100 equals 0.11 percent.) This loss of habitat is unlikely to appreciably reduce the distribution of the desert tortoise in relation to the range of the listed taxon.

Critical Habitat

We have previously discussed how the various aspects of the Air Force's activities would affect the primary constituent elements of critical habitat, so we will not repeat those analyses here. For the purposes of this analysis, we will assume that any future development within critical habitat is likely to reduce or eliminate the function of the primary constituent elements within the boundaries of that project's area; in terms of the analysis, this assumption likely overstates the effect because some of the primary constituent elements would likely remain after the implementation of at least some of the future actions.

The Air Force anticipates that it may need up to 5,000 acres for the development of new facilities, infrastructure, and new or expanded targets within the approximately 60,800 acres of critical habitat that lie within Edwards Air Force Base. Future development would likely be scattered throughout critical habitat in variously sized parcels. We expect that the Air Force is unlikely to situate larger developments within critical habitat because larger facilities would require more infrastructure support and most of the existing infrastructure is located outside of critical habitat.

The loss or disturbance of 5,000 acres of critical habitat during future development and operations of Edwards Air Force Base has the potential to increase the patchiness of suitable habitat because it could occur in numerous locations. Conversely, we do not expect that scattered development throughout the area of critical habitat within Edwards Air Force Base would measurably affect connectivity, either within or outside of the base. This amount of disturbance would also occupy a relatively small area of the critical habitat on base.

The 5,000 acres comprise approximately 0.96 percent of the Fremont-Kramer Critical Habitat Unit. (That is, 5,000 acres of development divided by 518,000 acres of critical habitat within the Fremont-Kramer Critical Habitat Unit times 100 equals 0.96 percent.) The Service must

consider the effects of a proposed action with regard to the entirety of the 6,446,200 acres of critical habitat that it designated. The 5,000 acres that may be lost or disturbed at Edwards Air Force Base comprise approximately 0.08 percent of critical habitat throughout the range. Because the amount of critical habitat to be lost or disturbed is so small relative to the entire designated area, it is not likely to appreciably diminish the value or function of critical habitat.

Effects on Recovery

Edwards Air Force Base occupies a relatively small portion of the Western Mojave Recovery Unit and an even smaller portion of the range of the desert tortoise. Consequently, the activities that the Air Force conducts on base under consideration in this biological opinion are unlikely to have an appreciable direct effect, either positively or negatively, on the recovery of the desert tortoise. The relatively small number of desert tortoises that we expect the Air Force to kill annually is unlikely to appreciably diminish the ability of the desert tortoise to reach stable or increasing population trends in the future. The Air Force's efforts to re-vegetate disturbed areas, close unneeded roads and unused excavations to reduce mortality of desert tortoises, and install exclusion fence and warning signs along roads to reduce mortality on active roads are likely to promote the conservation of the species within Edwards Air Force Base.

We do not consider the maintenance of head starting pens to raise desert tortoises for release to the wild to be an effective tool for recovery of the species at this time. Mortality rates among wild desert tortoises likely remain too high for desert tortoises released from head-starting pens to result in an expanded population; we also suspect that recruitment of reproductive animals from the ranks of juvenile desert tortoises is not occurring at a sustainable rate in at least some areas of the desert. Various studies have shown that protection of reproductive desert tortoises would contribute far more to the stabilization of population trends than the release of smaller individuals. Until we can improve the survival rate of reproductive desert tortoises (and rate of recruitment of juveniles to a reproductive size), the practice of head starting is highly unlikely to affect an increase in wild populations.

The Readiness and Environmental Protection Initiative would implement an important recovery task for the desert tortoise through the Air Force's acquisition in fee title or by easement lands with critical habitat that lie to the east of the base. These acquisitions would preclude the development of the land; such development is generally detrimental, both directly and indirectly, to the long-term conservation of the desert tortoise.

Overall, the operation of Edwards Air Force Base, as described in this biological opinion, including the development of solar energy facilities, is unlikely to adversely affect the recovery of the desert tortoise. We expect the adverse effects of the Air Force's operations to be relatively minor in relation to the range-wide status of the desert tortoise; the Air Force's on-base programs to restore habitat and reduce the mortality of desert tortoises have the potential to offset, to some degree, the adverse effects of its operations. If the Readiness and Environmental Protection Initiative is successfully implemented over time, the removal of the threat of development on

lands important to the long-term conservation of the desert tortoise would constitute an overall positive effect on recovery.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Most of the action area is entirely located within Edwards Air Force Base and is therefore on Federal lands; any future actions will be subject to the consultation requirements of section 7(a)(2) of the Act. A small portion of the action area extends from the northwestern corner of Edwards Air Force Base to the Windhub Substation on Oak Creek Road. We are unaware of any non-federal actions that are reasonably certain to occur in this area. Consequently, the proposed action has no associated cumulative effects.

CONCLUSION

Desert Tortoise

After reviewing its current status, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion for the following reasons. First, the Air Force has proposed measures to reduce the number of desert tortoises that are likely to be injured or killed in the course of its activities. Second, the few desert tortoises that the Air Force is likely to kill is a minor fraction of the number of desert tortoises range-wide; the loss of these animals is unlikely to measurably affect the number of desert tortoises or reproductive capacity of the listed taxon. Third, the Air Force's efforts to reduce hazards to desert tortoises (e.g., fencing roads and closing excavation in which they can become trapped) are likely to reduce the level of ongoing mortality on base. Fourth, the loss of habitat that is likely to occur during future activities at Edwards Air Force Base will not appreciably reduce the distribution of the desert tortoise.

Critical Habitat of the Desert Tortoise

After reviewing the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to result in the destruction or adverse modification of critical habitat of the desert tortoise. We have reached this conclusion because the amount of critical habitat that is likely to be affected comprises a small portion of the total amount of the critical habitat on Edwards Air Force Base, which itself is a small portion of the larger Fremont-Kramer Critical Habitat Unit and an even smaller portion of critical habitat range wide. Therefore, the amount of disturbance is not likely to compromise the conservation function and value of critical habitat for the desert tortoise.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not the purpose of, the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement and the avoidance and minimization measures proposed by the Air Force.

The measures described below are non-discretionary; the Air Force must implement these measures during the conduct of its activities or include them as binding conditions of any grant or permit issued to its customers and contractors, as appropriate, for the exemption in section 7(o)(2) to apply. The Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If the Air Force fails to assume and implement the terms and conditions or fails to require its customers and contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Air Force must report the progress of the actions and its impact on the species to the Service as specified in the incidental take statement (50 Code of Federal Regulations 402.14(i)(3)).

The Service anticipates that five desert tortoises per year are likely to be taken, in the form of mortality, as a result of the operation of Edwards Air Force Base. We derived this number through discussions with the Air Force and used it as the basis of our section 7(a)(2) analysis in this biological opinion. This number also serves as a basis for the re-initiation of formal consultation.

We do not expect removing desert tortoises from harm's way during the implementation of the Air Force's activities to result in their injury or mortality. Therefore, we are not including an anticipated amount or extent of this form of take (i.e., capture).

REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

The Air Force and Service agreed to several revisions to the proposed action during the course of formal consultation. Because these revisions have been incorporated into the proposed action of

this biological opinion, we have no additional reasonable and prudent measures or terms and conditions.

As described at the beginning of this section, the protective coverage of section 7(o)(2) may lapse if the Air Force does not abide by the protective measures described in this biological opinion. Additionally, the Air Force remains responsible for complying with the provisions of

Reporting Requirements and Disposition of Dead or Injured Specimens sections of this biological opinion.

REPORTING REQUIREMENTS

Pursuant to 50 Code of Federal Regulations 402.14(i)(3), the Air Force must provide a report to the Service that provides details on each desert tortoise that is killed or injured by its activities. In addition to the information that the Air Force will provide to the Service in its annual report, as described in the Administration of the Consultation section of this biological opinion, the report must also include information on any instances when desert tortoises were killed, injured, or handled, the circumstances of such incidents, and any actions undertaken to prevent similar instances from re-occurring. The report must also include a description of the monitoring efforts that occurred during implementation of actions that occur with desert tortoise habitat.

DISPOSITION OF DEAD OR INJURED SPECIMENS

Within 3 days of locating any dead or injured desert tortoises, the Air Force must notify the Ventura Fish and Wildlife Office by telephone (805 644-1766) and by facsimile or electronic mail. The report must include the date, time, and location of the carcass, a photograph, cause of death, if known, and any other pertinent information.

The Air Force must take any injured desert tortoises to a qualified veterinarian for treatment. If any injured desert tortoises survive, the Air Force must contact the Service regarding their final disposition.

Care must be taken in handling dead specimens to preserve biological material in the best possible state for later analysis, if such analysis is needed. The Service will make this determination when the Air Force provides notice that a desert tortoise has been killed by project activities.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service recognizes the effort that the Air Force's undertakes to conserve desert tortoises and their habitat. To meet its obligations under section 7(a)(1) of the Act, the Air Force has implemented several actions. For example, the Air Force has provided funds or personnel to conduct line-distance sampling within the Fremont-Kramer Critical Habitat Unit; the data generated by this sampling effort assists the Service in determining population trends across the range of the desert tortoise.

The Air Force is also working in conjunction with nongovernment conservation organizations to acquire lands through the Readiness and Environmental Protection Initiative program. This program supports cost-sharing partnerships authorized by Congress between the military, private conservation groups, and state and local governments to protect military test and training capabilities and conserve land. In the case of Edwards Air Force Base, the Air Force's goal of maintaining open space under the test flight corridors to the north of the base coincides with the Service's goal of conserving critical habitat of the desert tortoise.

The Air Force plans to continue to close and rehabilitate off-highway vehicle routes near the base and within the Fremont-Kramer Critical Habitat Unit to protect regional desert tortoise populations. Within Edwards Air Force Base, the Air Force plans to continue efforts to install desert tortoise barrier fencing and culverts along heavily traveled roads crossing desert tortoise habitat. The Air Force will prioritize the fencing of areas with high densities of desert tortoises or critical habitat; implementation of these actions is contingent upon available funding. To date, the Air Force has installed approximately 13 miles of desert tortoise exclusionary fencing along roads within Edwards Air Force Base.

In addition to these actions, we also recommend that the Air Force:

1. Assist the Service in implementation of the management plan for the common raven, control of feral dogs, management of subsidies for coyotes (*Canis latrans*), and numerous other activities that are intended to reduce the mortality levels of desert tortoises and improve habitat conditions.

2. Mark small desert tortoises from within project sites prior to their movement from harm's way or translocation. This marking would provide some information on their post-project status if they are encountered during future surveys or monitoring efforts. If the Air Force determines that it will include this requirement, we suggest that the authorized biologist contact the Desert Tortoise Recovery Office to ascertain the most appropriate means of marking the animals.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

RE-INITIATION NOTICE

This concludes formal consultation on operations at Edwards Air Force Base. As provided in 50 CFR 402.16, re-initiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) if the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) will have lapsed and any further take would be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending re-initiation.

If you have any questions, please contact Rachel Henry or Ray Bransfield of my staff at (805) 644-1766, extension 333 and 317.

Sincerely,

Stephen P. Henry
Acting Field Supervisor

Appendices

1. Mojave population of the desert tortoise (*Gopherus agassizii*). 5-year review: summary and evaluation. Available on disk or hard copy by request or at http://ecos.fws.gov/docs/five_year_review/doc3572.DT%205Year%20Review_FINAL.pdf.
2. Solar projects for which the U.S. Fish and Wildlife Service has issued biological opinions or incidental take permits.

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Appendix 2. Solar projects for which the U.S. Fish and Wildlife Service has issued biological opinions or incidental take permits.

The following table summarizes information regarding the proposed solar projects that have undergone formal consultation with regard to the desert tortoise. In the Citations column, a single reference indicates that the acres of desert tortoise habitat and number of desert tortoises are estimates from the biological opinion; when the column includes two citations, the first is for the acres of desert tortoise habitat from the biological opinion and the second is for number of desert tortoises that are known to have been translocated or killed during construction.

Project and Recovery Unit	**Acres of Desert Tortoise Habitat**	**Desert Tortoises Estimated[1]**	**Desert Tortoises Observed[2]**	**Citations[3]**
Eastern Mojave				
Ivanpah Solar Electric Generating System	3,582	1,136	173	Service 2011a, 2013d
Stateline Solar	1,685	94	-	Service 2013a
Silver State North – NV	685	14	4	Service 2010a, Cota 2013
Silver State South – NV	2,427[4]	122[4]	-	Service 2013a
Amargosa Farm Road – NV	4,350	4	-	Burroughs 2012
Western Mojave				
Abengoa Harper Lake	Primarily in abandoned agricultural fields	4	-	Service 2011b
Chevron Lucerne Valley	516	10	-	Service 2010b
Northeastern Mojave				
Nevada Solar One - NV	400	[5]	[5]	Burroughs 2012, 2014
Copper Mountain North - NV	1,400	30[5]	30[5]	Burroughs 2012, 2014
Copper Mountain - NV	380	[5]	[5]	Burroughs 2012, 2014
Moapa K Road Solar - NV	2,141	186	157	Service 2012, Burroughs 2013
Colorado				
Genesis	1,774	8	0	Service 2010c, Fraser 2014
Blythe	6,958	30	-	Service 2010d
Desert Sunlight	4,004	56	7	Service 2011c, Fraser 2014
McCoy	4,533	15	-	Service 2013b
Desert Harvest	1,300	5	-	Service 2013c
Rice	1,368	18	1	Service 2011d, Fraser 2014
Total	37,503	1,732	372	

1. The numbers in this column are not necessarily comparable because the methodologies for estimating the numbers of desert tortoises occasionally vary between projects.
2. This column reflects the numbers of desert tortoises observed within project areas. It includes translocated animals and those that were killed by project activities. Project activities may result in the deaths of more desert tortoises than are found.
3. The first citation in this column is for the biological opinion or incidental take permit and is the source of the information for both acreage and the estimate of the number of desert tortoises. The second is for the number of desert tortoises observed during construction of the project; where only one citation is present, construction has not begun or data are unavailable at this time.
4. These numbers include Southern California Edison's Primm Substation and its ancillary facilities.
5. These projects occurred under the Clark County Multi-species Habitat Conservation Plan; the provisions of the habitat conservation plan do not require the removal of desert tortoises. We estimate that all three projects combined will affect fewer than 30 desert tortoises.

The Service completed consultation on the Calico and Palen projects. The applicant for the Calico project, which was located in the Western Mojave Recovery Unit, has abandoned the project and the Bureau has withdrawn the request for consultation (Bureau 2013). For the Palen project, which is located in the Colorado Desert, BrightSource Energy acquired the project from its former owner and proposed to use power tower technology. The California Energy Commission denied the application but will allow BrightSource Energy to re-apply if it can resolve the issues the California Energy Commission raised. Because of the change in technology, the Bureau re-initiated formal consultation with the Service. As of the March 7, 2014, the Service and Bureau have not completed formal consultation on this project; consequently, we have removed it from the table.

Appendix 2: References Cited

Bureau of Land Management. 2013. Withdrawal of request for re-initiation of consultation for the Calico Solar Project. Dated August 09. Memorandum to Field Supervisor, Ventura Fish and Wildlife Office, Ventura, California. From Deputy State Director, California State Office. Sacramento, California.

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Fraser, J. 2014. Electronic mails. Status of solar projects in Colorado Desert. Dated January 27 and 28. Biologist, Palm Springs Fish and Wildlife Office, U.S. Fish and Wildlife Service. Palm Springs, California.

U.S. Fish and Wildlife Service. 2010a. Formal consultation for the Silver State Solar Project (NextLight Renewable Power, LLC), Clark County, Nevada. File No. 84320-2010-F-0208. Dated September 16. Memorandum to Field Manager, Pahrump Field Office, Bureau of Land Management, Las Vegas, Nevada. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2010b. Biological opinion on the Lucerne Valley Chevron Solar Project, San Bernardino County, California (8-8-10-F-6). Memorandum to Field Manager, Barstow Field Office, Bureau of Land Management, Barstow, California. Dated June 10. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2010c. Biological opinion on the Genesis Solar Energy Project, Riverside County, California. Memorandum to Field Manager, Palm Springs South Coast Field Office, Bureau of Land Management, Palm Springs, California. Dated November 2. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

U.S. Fish and Wildlife Service. 2010d. Biological opinion on the Blythe Solar Power Plant, Riverside County, California. Memorandum to Field Manager, Palm Springs South Coast Field Office, Bureau of Land Management, Palm Springs, California. Dated October 8. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

U.S. Fish and Wildlife Service. 2011a. Biological opinion on BrightSource Energy's Ivanpah Solar Electric Generating System Project, San Bernardino County, California [CACA-48668, 49502, 49503, 49504] (8-8-10-F-24R). Dated June 10. Memorandum to District Manager, California Desert District, Bureau of Land Management, Moreno Valley, California. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2011b. Biological opinion on the Mojave Solar, LLC's Mojave Solar Project, San Bernardino County, California (8-8-11-F-3). Letter sent to Director of Environmental Compliance, Loan Guarantee Program, Department of Energy, Washington, D.C. and Field Manager, Barstow Field Office, Bureau of Land Management, Barstow, California. Dated March 17. From Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2011c. Biological opinion on the Desert Sunlight Solar Farm Project, Riverside County, California. Memorandum to Field Manager, Palm Springs South Coast Field Office, Bureau of Land Management, Palm Springs, California. Dated July 6. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California

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U.S. Fish and Wildlife Service. 2012. Biological opinion for the K Road Moapa Solar Project, Moapa River Indian Reservation, Clark County, Nevada. Memorandum to Superintendent, Southern Paiute Agency, Bureau of Indian Affairs. St. George, Utah. Dated March 7. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

U.S. Fish and Wildlife Service. 2013a. Biological opinion for the Stateline Solar and Silver State Solar South Projects, San Bernardino County, California, and Clark County, Nevada. Dated September 30. Memorandum to Field Manager, Needles Field Office, Bureau of Land Management, Needles California, and Assistant Field Manager, Las Vegas Field Office, Bureau of Land Management, Las Vegas, Nevada. From Acting Field Supervisor, Ventura Fish and Wildlife Office. Ventura, California.

U.S. Fish and Wildlife Service. 2013b. Biological opinion on the McCoy Solar Power Project, Riverside County, California. Dated March 6. Memorandum to Field Manager, California Desert District Office, Bureau of Land Management, Moreno Valley, California. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

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APPENDIX D – Comment Letter and Responses on the Draft Environmental Assessment

APPENDIX D

COMMENT LETTER AND RESPONSES ON THE DRAFT EA

Relevant federal and state resource agencies and Native American tribes, and local document repositories on the project mailing list have been sent notification on the Proposed Action and Alternatives. The Draft EA was filed with California Office of Planning and Research (State Clearinghouse) for distribution to appropriate State and regional agencies for review and comment. One letter from the RWQCB was received. This letter, as well as responses to the letter, are provided in this appendix. Each comment in the letter has been given a unique comment number for ease of tracking the comments and responses.

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Lahontan Regional Water Quality Control Board

October 26, 2016

File: WDID: 6B150316001
Environmental Doc Review,
Kern County

Gary Hatch
United States Air Force Department of Defense
Edwards Air Force Base
305 E. Popson Ave.
Edwards AFB, CA 93524

Comments on the Draft Environmental Assessment Long-Term Integrated Management of Mission-Generated Solid Waste, Edwards Air Force Base, Kern County, State Clearinghouse No. 2016094003

California Regional Water Quality Control Board, Lahontan Region (Water Board) staff received the Environmental Assessment and Finding of No Significant Impact (EA/FONSI) on the above-referenced project (Project) on October 3, 2016. The EA/FONSI for Long-Term Management of Mission-Generated Solid Wastes at Edwards Air Force Base was prepared by the United States Air Force Department of Defense (USAF) to evaluate potential impacts and required mitigation for the continuation of operation or closing of the Main Base Active Landfill (MBAL), and establish a reasonable long-term plan for proper disposition of Base-generated solid waste. The EA evaluated potential environmental impacts associated with the long-term integrated management of the mission-generated solid waste. Alternatives evaluated included closure of the MBAL, reducing operating days at the MBAL, and increasing the permitted capacity of the MBAL. The EA/FONSI was circulated by the USAF in compliance with the provisions of NEPA in order to solicit input and considerations for potential additional environmental analysis and compliance with any other applicable regulations.

Water Board staff, acting as a responsible agency, is providing these comments to specify the scope and content of the environmental information germane to our statutory responsibilities pursuant to CEQA Guidelines, California Code of Regulations, title 14, section 15096. We thank the USAF for considering our comments and our position with respect to protecting and maintaining water quality in the Lahontan Region. Our comments are outlined below.

Water Board's Authority

All groundwater and surface waters are considered waters of the State. Surface waters include streams, lakes, ponds, and wetlands, and may be ephemeral, intermittent, or perennial. All waters of the State are protected under California law. State law assigns responsibility for protection of water quality in the Lahontan Region to the Lahontan Water Board. Some waters of the State are also waters of the U.S. The Federal Clean Water Act (CWA) provides additional protection for those waters of the State that are also waters of the U.S.

The *Water Quality Control Plan for the Lahontan Region* (Basin Plan) contains policies that the Water Board uses with other laws and regulations to protect the quality of waters of the State within the Lahontan Region. The Basin Plan sets forth water quality standards for surface water and groundwater of the Region, which include designated beneficial uses as well as narrative and numerical objectives which must be maintained or attained to protect those uses. The Basin Plan can be accessed via the Water Board's web site at http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml.

Specific Issues to be Considered

1. The State Water Board or the Regional Water Board (collectively referred to as
Water Boards) may need to issue discretionary permits for implementation of the
Project, we request that the environmental document prepared for the Project 1 - 1
comply with and satisfy the requirements of both NEPA and CEQA. The Water
Boards cannot take a discretionary action or issue a permit until CEQA has been
satisfied.

2. Offsite transport and disposal of waste should evaluate the impacts of the vehicle
traffic and the impact on the capacity of other disposal sites being considered. 1 - 2

3. Project areas may include marked (blue line) and unmarked surface waters that
are either waters of the U.S. and/or waters of the State. Surface waters include,
but are not limited to, drainages, streams, washes, ponds, pools, or wetlands, 1 - 3
and may be permanent or intermittent. Waters of the State may include waters
determined to be isolated or otherwise non-jurisdictional by the U.S. Army Corps
of Engineers (USACE).

4. The beneficial uses of water resources in the Lahontan Region are listed either
by watershed (for surface waters) or by groundwater basin (for groundwater) in
Chapter 2 of the Basin Plan. The environmental document should identify and 1 - 4
list the beneficial uses of the water resources within the Project area and include
an analysis of the potential impacts to water quality and hydrology with respect to
those beneficial uses.

5. Water quality objectives and standards, both numerical and narrative, for all waters of the State within the Lahontan Region, including surface waters and groundwater, are outlined in Chapter 3 of the Basin Plan. Water quality objectives and standards are intended to protect the public health and welfare, and to maintain or enhance water quality in relation to the existing and/or potential beneficial uses of the water. It is these objectives and standards that should be used when evaluating thresholds of significance for Project impacts. 1 - 5

6. Equipment staging areas should be sited in upland areas outside stream channels and other surface waters on or around the Project site. Buffer areas should be identified and exclusion fencing used to protect the water resource and prevent unauthorized vehicles or equipment from entering or otherwise disturbing the surface waters. Equipment should use existing roadways to the extent feasible. 1 - 6

7. The Water Board requires that impacts to water resources be avoided where feasible and minimized to the extent practical. Compensatory mitigation will be required for all unavoidable permanent impacts to surface water resources. Water Board staff coordinate all mitigation requirements with staff from other federal and state regulatory agencies, including the USACE and the California Department of Fish and Wildlife. In determining appropriate mitigation ratios for impacts to waters of the State, Water Board staff considers Basin Plan requirements (minimum 1.5:1 mitigation ratio for impacts to wetlands) and utilizes *12501-SPD Regulatory Program Standard Operating Procedure for Determination of Mitigation Ratios*, published December 2012 by the USACE, South Pacific Division. 1 - 7

8. As noted above, drainages are considered surface waters. The environmental document should provide specific information regarding impacts to surface water, specifically the re-routing of the drainage, placement and sizing of any culverts, and any mitigation that may be required. The environmental document needs to quantify these impacts and discuss the purpose of the project, need for surface water disturbance, and propose alternatives (in order to first avoid impacts and minimize disturbances, and propose mitigation for unavoidable impacts). We request that measures be incorporated into the project to avoid surface waters and provide buffer zones where possible. If the proposed project impacts and alters drainages, then we request that the project proponent obtain permit coverage and that the project be designed such that it would maintain existing hydrologic features and patterns to the extent feasible. Water Board staff encourage early consultation with the Water Board prior to commencement of the project. Because mitigation will likely be required, a Mitigated Negative Declaration should be prepared for the project, at a minimum. 1 - 8

9. BMPs are used to reduce pollutants in runoff to waters of the State. Construction Storm Water BMPs shall be implemented during active and post construction to manage storm water and minimize impacts from storm water runoff, such as 1 - 9

erosion. The environmental document must specifically describe BMPs and their role in mitigation of project impacts. Keep in mind that mitigation must protect functions and values, and that measures must be identified and discussed in the environmental document. For more information, see the Basin Plan, which can be accessed via the Water Board's web site (http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml). 1 - 9 (continued)

Permitting Requirements

A number of activities associated with the proposed Project have the potential to impact waters of the State and, therefore, may require permits issued by either the State Water Resources Control Board (State Water Board) or Lahontan Water Board. The required permits may include the following.

1. The MBAL is regulated under Waste Discharge Requirements (WDR), Board Order No. R6V-2002-0019, issued by the Lahontan Water Board. Closure activities associated with the proposed Project will require the issuance of closure WDRs by the Lahontan Water Board pursuant to the California Code of Regulations (CCR), title 27. Should the USAF pursue closure of the MBAL, the USAF will need to submit a complete revised report of waste discharge and final closure plan at least 120 days prior to the initiation of closure activities. 2- 1

2. The proposed vertical expansion should evaluate the final proposed capacity and how the design will comply with requirements of CCR, title 27. 2 - 2

3. Streambed alteration and/or discharge of fill material to a surface water may require a CWA, section 401 water quality certification for impacts to federal waters (waters of the U.S.), or dredge and fill waste discharge requirements for impacts to non-federal waters, both issued by the Lahontan Water Board or State Water Board. 2 - 3

4. Any land disturbance and/or construction must implement best management practices (BMPs) designed to minimize erosion or other impacts to drainages. The environmental document should include additional project-specific information regarding impacts from any potential water diversions, and describe the impacts and BMPs that will be implemented during necessary mitigation to reduce pollutants in runoff to waters of the State. 2 - 4

5. Water diversion and/or dewatering activities may be subject to discharge and monitoring requirements under either NPDES General Permit, Limited Threat Discharges to Surface Waters, Board Order R6T-2014-0049, or General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality, WQO-2003-0003, both issued by the Lahontan Water Board. 2 - 5

Please be advised of the permits that may be required for the proposed Project, as outlined above. The specific Project activities that may trigger these permitting actions

should be identified in the appropriate sections of the environmental document. Should Project implementation result in activities that trigger these permitting actions, the Project proponent must consult with Water Board staff. Information regarding these permits, including application forms, can be downloaded from our web site at http://www.waterboards.ca.gov/lahontan/.

Thank you for the opportunity to comment on the EA/FONSI. If you have any questions regarding this letter, please contact me at (760) 241-7333, christina.guerra@waterboards.ca.gov or Cindi Mitton, Senior Water Resources Control Engineer, at (760) 241-7414, cindi.mitton@waterboards.ca.gov.

Christina Guerra

Christina Guerra
Engineering Geologist

cc: State Clearinghouse (SCH 2016094003), stateclearinghouse@opr.ca.gov
USEPA Region 9, Wetlands Regulatory Office, R9-WTR8-Mailbox@epa.gov
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Kevin Depies, DTSC, kevin.depies@dtsc.ca.gov

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LETTER FROM LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD, DATED OCTOBER 26, 2016

California Water Boards
Lahontan Regional Water Quality Control Board
2501 Lake Tahoe Boulevard
South Lake Tahoe, California 96150
Christina Guerra
Engineering Geologist

SPECIFIC ISSUES TO BE CONSIDERED

RESPONSE TO COMMENT 1-1

Edwards AFB understands that discretionary permits may be required for project implementation, whether it be landfill closure or expansion. They would be applied for at such time as the Air Force makes a decision to close or expand the landfill. A CEQA document for the action would also be prepared at that time. A new Section 1.4 (Regulatory Requirements) was added to the EA to identify potential future permitting and CEQA requirements.

RESPONSE TO COMMENT 1-2

Edwards AFB did a qualitative look at traffic and off base disposal of the waste in the EA. The number of trips associated with the current waste stream of 10 to 12 tons per day of waste is so small as to be negligible from a traffic standpoint. The daily tonnages at the landfills considered for offsite disposal (in Mojave, Boron and Lancaster) were below their permitted maximum and, therefore, it was assumed that they should have no problem accepting the waste.

RESPONSE TO COMMENT 1-3

No field work was conducted to determine Waters of the State (there are no Waters of the U.S. on the base) in the project area for this EA, but this would likely need to be done at a later date as part of the state permitting process needed for closure (or vertical expansion) of the landfill. Additional information regarding jurisdictional waters has been added to Section 3.9.1 (Surface Water in the Vicinity of the Main Base Landfill) of the EA.

RESPONSE TO COMMENT 1-4

Other than use as dust control, there are no beneficial uses for groundwater at the landfill. Either closing or expanding the landfill would not change this use. Additional text regarding water use and beneficial uses of groundwater at the landfill has been added to Section 3.9.2 (Groundwater in the Vicinity of the Main Base Landfill).

RESPONSE TO COMMENT 1-5

Edwards AFB understands that water quality objectives and standards for waters of the State within the Lahontan Region would need to be identified and used in evaluating project impacts at such time that the landfill is specifically proposed for closure. Additional text has been added to the following sections of the EA: the new Section 1.4 (Regulatory Requirements) to identify potential future permitting and CEQA requirements; Section 3.9.1 (Surface Water in the Vicinity of the Main Base Landfill) regarding jurisdictional waters; Section 3.9.2 (Groundwater in the Vicinity of the Main Base Landfill) regarding water use and beneficial uses of groundwater at the landfill; and to Section 4.9 (Hydrology and Water Quality) for clarification in the impacts analysis.

RESPONSE TO COMMENT 1-6

Edwards AFB agrees that equipment staging areas should be sited in upland areas outside stream channels and other surface waters on and around the project site. Clarifying language has been added to the impacts discussion in Section 4.9.2 (Alternative 1 – Closure of the Landfill) of the EA.

RESPONSE TO COMMENT 1-7

Edwards AFB agrees that impacts to water resources be avoided where feasible and minimized to the extent practical. Clarifying language has been added to the impacts discussion and an additional mitigation measure has been added in Section 4.9.2 (Alternative 1 – Closure of the Landfill) of the EA.

RESPONSE TO COMMENT 1-8

The existing Preliminary Closure and Post-Closure Maintenance Plan (PCPCMP) has a drainage design to handle the 100-year, 24-hour storm in accordance with CCR Title 27 requirements. A vertical expansion would not change the footprint of the landfill or perimeter drainage. At such time that Edwards AFB decides to close the landfill, the PCPCMP will be finalized and specific information will be provided regarding impacts to surface water, specifically the re-routing of the drainage, placement and sizing of any culverts, and any mitigation that may be required. Additional text has been added to the following sections of the EA to clarify the permitting requirements and potential impacts of closure of the landfill: the new Section 1.4 (Regulatory Requirements) to identify potential future permitting and CEQA requirements; Section 3.9.1 (Surface Water in the Vicinity of the Main Base Landfill) regarding jurisdictional waters; Section 3.9.2 (Groundwater in the Vicinity of the Main Base Landfill) regarding water use and beneficial uses of groundwater at the landfill; and to Section 4.9 (Hydrology and Water Quality) for clarification in the impacts analysis.

RESPONSE TO COMMENT 1-9

Edwards AFB agrees that Best Management Practices (BMPs) would be used to reduce pollutants in runoff to waters of the State. However, they are specific to the action chosen and Edwards AFB has not yet made a decision to close or expand the landfill. At the time that such a decision is made, a detailed closure plan or vertical expansion plan will be developed and will include specific BMPs. BMPs typical to this type of activity include silt fences, fiber rolls, sediment/infiltration basins, and hydroseeding/vegetation establishment. Clarifying language has been added to Section 4.9.2 (Alternative 1 – Closure of the Landfill) of the EA.

PERMITTING REQUIREMENTS

RESPONSE TO COMMENT 2-1

As discussed in Response to Comment 1-1, Edwards AFB understands that discretionary permits may be required for project implementation, whether it be landfill closure or expansion. They would be applied for at such time as the Air Force makes a decision to close or expand the

landfill. A CEQA document for the action would also be prepared at that time. A new Section 1.4 (Regulatory Requirements) was added to the EA to identify potential future permitting and CEQA requirements. In particular, Section 1.4 states that "regulatory requirements for closing the landfill include issuance of closure WDRs by the RWQCB pursuant to CCR, Title 27. As part of this, Edwards AFB would need to submit a complete revised report of waste discharge and final closure plan at least 120 days prior to the initiation of closure activities. At that time, potential impacts to waters subject to regulatory authority by the State of California would be identified along with appropriate Best Management Practices (BMPs) designed to minimize erosion or other impacts to drainages. Vertical expansion of the landfill would also be subject to the requirements of CCR, Title 27."

RESPONSE TO COMMENT 2-2

Refer to Response to Comment 2-1. Edwards AFB understands that vertical expansion of the landfill would be subject to the requirements of CCR, Title 27.

RESPONSE TO COMMENT 2-3

Refer to Response to Comment 2-1. As previously described in Responses to Comments 1-8 and 1-9, additional text has been added to the various sections of the EA to clarify the permitting requirements and potential impacts of closure of the landfill.

RESPONSE TO COMMENT 2-4

Refer to Response to Comment 1-9.

RESPONSE TO COMMENT 2-5

Closure of the landfill would not require any dewatering activities. A preliminary drainage plan has been developed in the PCPCMP. Refer to Response to Comment 1-8.